

**RKDF UNIVERSITY, BHOPAL**  
**Minutes of Meeting**

**Committee for Ph. D. Course Work**

1.	Program/Course Name	Doctor of Philosophy (Ph. D.) Course work																										
2.	Subject	<table style="width: 100%; border: none;"> <tr> <td style="width: 50%;">Pharmaceutical Sciences</td> <td style="width: 50%;">Biotechnology</td> </tr> <tr> <td>Civil Engineering</td> <td>Botany</td> </tr> <tr> <td>Computer Science and Engineering</td> <td>Chemistry</td> </tr> <tr> <td>Electrical Engineering</td> <td>Commerce</td> </tr> <tr> <td>Mechanical Engineering</td> <td>Management</td> </tr> <tr> <td>Electronic and Communication Engineering</td> <td>Economics</td> </tr> <tr> <td>Computer Science Application</td> <td>Education</td> </tr> <tr> <td>Mathematics</td> <td>English</td> </tr> <tr> <td>Geography</td> <td>Law</td> </tr> <tr> <td>Microbiology</td> <td>Genetics</td> </tr> <tr> <td>Political Science</td> <td>Physics</td> </tr> <tr> <td>Sociology</td> <td>Sanskrit</td> </tr> <tr> <td>Environmental Sciences</td> <td>Zoology</td> </tr> </table>	Pharmaceutical Sciences	Biotechnology	Civil Engineering	Botany	Computer Science and Engineering	Chemistry	Electrical Engineering	Commerce	Mechanical Engineering	Management	Electronic and Communication Engineering	Economics	Computer Science Application	Education	Mathematics	English	Geography	Law	Microbiology	Genetics	Political Science	Physics	Sociology	Sanskrit	Environmental Sciences	Zoology
Pharmaceutical Sciences	Biotechnology																											
Civil Engineering	Botany																											
Computer Science and Engineering	Chemistry																											
Electrical Engineering	Commerce																											
Mechanical Engineering	Management																											
Electronic and Communication Engineering	Economics																											
Computer Science Application	Education																											
Mathematics	English																											
Geography	Law																											
Microbiology	Genetics																											
Political Science	Physics																											
Sociology	Sanskrit																											
Environmental Sciences	Zoology																											
3	Members present	Dr. M. L. Kori, Dr. N. K. Shrivastava, Dr. A.C. Nayak, Dr. C. B. S. Dangi																										
4	Date of Meeting	11/03/2020																										
5	Venue of meeting	Board Room, Administrative Building, RKDF University, Bhopal																										
6	New	New																										
7	Agenda	<p><b>Item No.1</b> Inclusion and implementation of Research and Publication Ethics (RPE) as a compulsory for all Ph. D. students as per UGC letter D.O.No.F.1-1/2018(Journal/CARE) dated December, 2019.</p> <p><b>Item No.2</b> Finalization and implementation of subject title, subject code and teaching scheme of compulsory subject.</p> <p><b>Item No.3</b> Finalization and implementation of examination scheme of compulsory subject.</p> <p><b>Item No.4</b> Finalization and implementation of syllabus of compulsory subject.</p> <p><b>Item No.5</b> Revision of subject code of all subjects</p>																										
8	Minutes	<p>At the outset, Dr. M L Kori, Chairman, Committee, welcomed all present and briefed the agenda of the meeting to finalize and implementation of compulsory subject's syllabus and schemes for Ph. D. course work for all disciplines. All the members of committee for Ph. D. course work discussed the agenda items thoroughly.</p> <p>The committee studied Annexure 1 of UGC letter D.O.No.F.1-1/2018(Journal/CARE) dated December, 2019 for compulsory subject RPE, after thorough discussion on the proposed subject RPE. All members were agreed for implementation as such under agenda Item No.1 to 4.</p>																										

## 9. Recommendations:

All the members of the committee discussed the agenda items and finalized the following recommendations

1. Research and Publication Ethics (RPE) as a compulsory subject for all Ph. D. students as per UGC D.O.No.F.1-1/2018(Journal/CARE) dated December, 2019 for pre-registration course work has been recommended for inclusion and implementation from the academic session 2020-2021
2. Finalization and implementation of subject title, all subjects' code and teaching scheme as mentioned in Table 1.
3. Finalization and implementation of examination scheme of compulsory subject RPE as shown in Table 2.
4. Finalization and implementation of syllabus of compulsory subject RPE attached in Annexure-I.

*he-11/03/2020*  
Dr. M. L. Kori  
Chairman

Dr. C. B. S. Dangi  
Member

*(Na)*  
Dr. A.C. Nayak  
Member

*MS*  
Dr. N. K. Shrivastava  
Member

The meeting ended with vote of thanks to all.  
Thanks

**Table 1. Subject Name and subject code for Ph. D course work****a) Compulsory Subject**

S. No.	Subject Name	Subject Code
1.	RESEARCH METHODOLOGY	PHD101RM01
2.	RESEARCH AND PUBLICATION ETHICS	CPE-RPE002

**b) Elective**

S. No.	Subject Name	Subject Code
1.	PHARMACOLOGY	PHD102PS01
2.	PHARMACOLOGY AND TOXICOLOGY	PHD102PS02
3.	PHARMACEUTICAL ADMINISTRATION	PHD102PS03
4.	PHARMACEUTICAL ANALYSIS	PHD102PS04
5.	PHARMACEUTICAL ASSURANCE	PHD102PS05
6.	PHARMACEUTICAL BIOTECHNOLOGY	PHD102PS06
7.	PHARMACEUTICAL CHEMISTRY	PHD102PS07
8.	PHARMACEUTICAL MARKETING MANAGEMENT	PHD102PS08
9.	PHARMACEUTICAL TECHNOLOGY	PHD102PS09
10.	PHARMACEUTICS	PHD102PS10
11.	PHARMACEUTICS (DRUG REGULATORY AFFAIRS)	PHD102PS11
12.	PHARMACOGNOSY	PHD102PS12
13.	PHARMACOGNOSY AND PHYTOCHEMISTRY	PHD102PS13
14.	PHARMACOGNOSY HERBAL DRUGS	PHD102PS14
15.	PHARMACY PRACTICE	PHD102PS15
16.	PHARMACEUTICAL MANAGEMENT AND REGULATORY AFFAIRS	PHD102PS16
17.	PHARMACEUTICAL ANALYSIS AND QUALITY CONTROL	PHD102PS17
18.	PHARMACEUTICAL ANALYSIS AND QUALITY ASSURANCE	PHD102PS18
19.	PHARMACY PRACTICE AND CLINICAL PHARMACY	PHD102PS19
20.	PHYTO CHEMISTRY	PHD102PS20
21.	PHYTOPHARMACY AND PHYTO MEDICINE	PHD102PS21
22.	QUALITY ASSURANCE AND PHARMACY REGULATORY AFFAIRS	PHD102PS22
23.	NEW DRUG DELIVERY SYSTEM	PHD102PS23
24.	PHARMACEUTICAL CHEMISTRY	PHD102PS24
25.	INDUSTRIAL PHARMACY	PHD102PS25
26.	HOSPITAL AND CLINICAL PHARMACY	PHD102PS26
27.	DRUG DISCOVERY & DRUG DEVELOPMENT	PHD102PS27
28.	BIOPHARMACEUTICS	PHD102PS28
29.	CLINICAL PRACTICE AND RESEARCH	PHD102PS29

30.	PHARMACY MANAGEMENT	PHD102PS30
31.	BIOTECHNOLOGY	PHD102BT01
32.	PLANT SCIENCE	PHD102BN01
33.	INSTRUMENTAL METHODS OF ANALYSIS IN CHEMISTRY	PHD102CH01
34.	CIVIL ENGINEERING	PHD102CE01
35.	COMPUTER SCIENCE AND ENGINEERING	PHD102CS01
36.	ELECTRICAL ENGINEERING	PHD102EE01
37.	ELECTRONIC AND COMMUNICATION ENGINEERING	PHD102EC01
38.	MECHANICAL ENGINEERING	PHD102ME01
39.	HUMAN RESOURCE MANAGEMENT	PHD102MG01
40.	FINANCIAL MANAGEMENT	PHD102MG02
41.	MANAGEMENT ACCOUNTING	PHD102MG03
42.	MARKETING MANAGEMENT	PHD102MG04
43.	PRINCIPLE AND PRACTICES OF MANAGEMENT	PHD102MG05
44.	COMPUTER SCIENCE & APPLICATIONS	PHD102CA01
45.	RECENT TRENDS IN COMMERCE & MANAGEMENT	PHD102CM01
46.	ECONOMICS	PHD102CM02
47.	EDUCATION	PHD102ED01
48.	ENGLISH	PHD102EN01
49.	ENVIRONMENTAL SCIENCES	PHD102ES01
50.	GENETICS	PHD102GE01
51.	GEOGRAPHY	PHD102GG01
52.	LAW	PHD102LW01
53.	MATHEMATICS	PHD102MT01
54.	MICROBIOLOGY	PHD102MB01
55.	PHYSICS	PHD102PH01
56.	POLITICAL SCIENCE AND PUBLIC ADMINISTRATION	PHD102PL01
57.	ADVANCE IN SANSKRIT LANGUAGE	PHD102SL01
58.	SOCIAL WORK	PHD102SW01
59.	ZOOLOGY	PHD102ZL01

**c) Elective (Practical/Workshop)**

S. No.	Subject Name	Subject Code
1.	PHARMACOLOGY	PHD103PS01
2.	PHARMACOLOGY AND TOXICOLOGY	PHD103PS02
3.	PHARMACEUTICAL ADMINISTRATION	PHD103PS03
4.	PHARMACEUTICAL ANALYSIS	PHD103PS04
5.	PHARMACEUTICAL ASSURANCE	PHD103PS05
6.	PHARMACEUTICAL BIOTECHNOLOGY	PHD103PS06

7.	PHARMACEUTICAL CHEMISTRY	PHD103PS07
8.	PHARMACEUTICAL MARKETING MANAGEMENT	PHD103PS08
9.	PHARMACEUTICAL TECHNOLOGY	PHD103PS09
10.	PHARMACEUTICS	PHD103PS10
11.	PHARMACEUTICS (DRUG REGULATORY AFFAIRS)	PHD103PS11
12.	PHARMACOGNOSY	PHD103PS12
13.	PHARMACOGNOSY AND PHYTOCHEMISTRY	PHD103PS13
14.	PHARMACOGNOSY HERBAL DRUGS	PHD103PS14
15.	PHARMACY PRACTICE	PHD103PS15
16.	PHARMACEUTICAL MANAGEMENT AND REGULATORY AFFAIRS	PHD103PS16
17.	PHARMACEUTICAL ANALYSIS AND QUALITY CONTROL	PHD103PS17
18.	PHARMACEUTICAL ANALYSIS AND QUALITY ASSURANCE	PHD103PS18
19.	PHARMACY PRACTICE AND CLINICAL PHARMACY	PHD103PS19
20.	PHYTO CHEMISTRY	PHD103PS20
21.	PHYTOPHARMACY AND PHYTO MEDICINE	PHD103PS21
22.	QUALITY ASSURANCE AND PHARMACY REGULATORY AFFAIRS	PHD103PS22
23.	NEW DRUG DELIVERY SYSTEM	PHD103PS23
24.	PHARMACEUTICAL CHEMISTRY	PHD103PS24
25.	INDUSTRIAL PHARMACY	PHD103PS25
26.	HOSPITAL AND CLINICAL PHARMACY	PHD103PS26
27.	DRUG DISCOVERY & DRUG DEVELOPMENT	PHD103PS27
28.	BIOPHARMACEUTICS	PHD103PS28
29.	CLINICAL PRACTICE AND RESEARCH	PHD103PS29
30.	PHARMACY MANAGEMENT	PHD103PS30
31.	BIOTECHNOLOGY	PHD103BT01
32.	PLANT SCIENCE	PHD103BN01
33.	INSTRUMENTAL METHODS OF ANALYSIS IN CHEMISTRY	PHD103CH01
34.	CIVIL ENGINEERING	PHD103CE01
35.	COMPUTER SCIENCE AND ENGINEERING	PHD103CS01
36.	ELECTRICAL ENGINEERING	PHD103EE01
37.	ELECTRONIC AND COMMUNICATION ENGINEERING	PHD103EC01
38.	MECHANICAL ENGINEERING	PHD103ME01
39.	HUMAN RESOURCE MANAGEMENT	PHD103MG01
40.	FINANCIAL MANAGEMENT	PHD103MG02
41.	MANAGEMENT ACCOUNTING	PHD103MG03
42.	MARKETING MANAGEMENT	PHD103MG04
43.	PRINCIPLE AND PRACTICES OF MANAGEMENT	PHD103MG05

44.	COMPUTER SCIENCE & APPLICATIONS	PHD103CA01
45.	RECENT TRENDS IN COMMERCE & MANAGEMENT	PHD103CM01
46.	ECONOMICS	PHD103CM02
47.	EDUCATION	PHD103ED01
48.	ENGLISH	PHD103EN01
49.	ENVIRONMENTAL SCIENCES	PHD103ES01
50.	GENETICS	PHD103GE01
51.	GEOGRAPHY	PHD103GG01
52.	LAW	PHD103LW01
53.	MATHEMATICS	PHD103MT01
54.	MICROBIOLOGY	PHD103MB01
55.	PHYSICS	PHD103PH01
56.	POLITICAL SCIENCE AND PUBLIC ADMINISTRATION	PHD103PL01
57.	ADVANCE IN SANSKRIT LANGUAGE	PHD103SL01
58.	SOCIAL WORK	PHD103SW01
59.	ZOOLOGY	PHD103ZL01

#### d) Project Work

S. No.	Subject Name	Subject Code
1.	PHARMACOLOGY	PHD104PS01
2.	PHARMACOLOGY AND TOXICOLOGY	PHD104PS02
3.	PHARMACEUTICAL ADMINISTRATION	PHD104PS03
4.	PHARMACEUTICAL ANALYSIS	PHD104PS04
5.	PHARMACEUTICAL ASSURANCE	PHD104PS05
6.	PHARMACEUTICAL BIOTECHNOLOGY	PHD104PS06
7.	PHARMACEUTICAL CHEMISTRY	PHD104PS07
8.	PHARMACEUTICAL MARKETING MANAGEMENT	PHD104PS08
9.	PHARMACEUTICAL TECHNOLOGY	PHD104PS09
10.	PHARMACEUTICS	PHD104PS10
11.	PHARMACEUTICS (DRUG REGULATORY AFFAIRS)	PHD104PS11
12.	PHARMACOGNOSY	PHD104PS12
13.	PHARMACOGNOSY AND PHYTOCHEMISTRY	PHD104PS13
14.	PHARMACOGNOSY HERBAL DRUGS	PHD104PS14
15.	PHARMACY PRACTICE	PHD104PS15
16.	PHARMACEUTICAL MANAGEMENT AND REGULATORY AFFAIRS	PHD104PS16
17.	PHARMACEUTICAL ANALYSIS AND QUALITY CONTROL	PHD104PS17
18.	PHARMACEUTICAL ANALYSIS AND QUALITY ASSURANCE	PHD104PS18

19.	PHARMACY PRACTICE AND CLINICAL PHARMACY	PHD104PS19
20.	PHYTO CHEMISTRY	PHD104PS20
21.	PHYTOPHARMACY AND PHYTO MEDICINE	PHD104PS21
22.	QUALITY ASSURANCE AND PHARMACY REGULATORY AFFAIRS	PHD104PS22
23.	NEW DRUG DELIVERY SYSTEM	PHD104PS23
24.	PHARMACEUTICAL CHEMISTRY	PHD104PS24
25.	INDUSTRIAL PHARMACY	PHD104PS25
26.	HOSPITAL AND CLINICAL PHARMACY	PHD104PS26
27.	DRUG DISCOVERY & DRUG DEVELOPMENT	PHD104PS27
28.	BIOPHARMACEUTICS	PHD104PS28
29.	CLINICAL PRACTICE AND RESEARCH	PHD104PS29
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31.	BIOTECHNOLOGY	PHD104BT01
32.	PLANT SCIENCE	PHD104BN01
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43.	PRINCIPLE AND PRACTICES OF MANAGEMENT	PHD104MG05
44.	COMPUTER SCIENCE & APPLICATIONS	PHD104CA01
45.	RECENT TRENDS IN COMMERCE & MANAGEMENT	PHD104CM01
46.	ECONOMICS	PHD104CM02
47.	EDUCATION	PHD104ED01
48.	ENGLISH	PHD104EN01
49.	ENVIRONMENTAL SCIENCES	PHD104ES01
50.	GENETICS	PHD104GE01
51.	GEOGRAPHY	PHD104GG01
52.	LAW	PHD104LW01
53.	MATHEMATICS	PHD104MT01
54.	MICROBIOLOGY	PHD104MB01
55.	PHYSICS	PHD104PH01
56.	POLITICAL SCIENCE AND PUBLIC ADMINISTRATION	PHD104PL01
57.	ADVANCE IN SANSKRIT LANGUAGE	PHD104SL01

58.	SOCIAL WORK	PHD104SW01
59.	ZOOLOGY	PHD104ZL01

**Table 2. Teaching Scheme for Ph. D course work**

S. No.	Subject code	Subject	Credits	Hours/week
1	PHD101RM01	Research Methodology	04	6
	CWE-RPE002	Research and Publication Ethics	02	2
2	Code of Respective Elective Subject	Elective	04	6
3	Code of Respective Elective Subject	Elective (Practical/Workshop)	02	8
4	Code of Respective Elective Subject	Project Work	00	16
<b>Total</b>			<b>10</b>	<b>36</b>

01 credit=15 hours

**Table 3. Examination Scheme for Ph. D course work**

S. No.	Subject code	Subject	Maximum marks	Minimum marks
1	PHD101RM01	Research Methodology	100	50
	CWE-RPE002	Research and Publication Ethics	50	25
2	Code of Respective Elective Subject	Elective	100	50
3	Code of Respective Elective Subject	Elective (Practical/Workshop)	50	25
4	Code of Respective Elective Subject	Project Work		

Cumulative pass percentage: 65%



<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	All Discipline	<b>Contact Hours</b>	75
<b>Subject Name</b>	Research Methodology	<b>Subject Code</b>	PHD101RM01

**Course Content**

**Introduction to Research Methodology** - Meaning and characteristics of scientific research, validity in research, objectives of research, motivations in research, types of research, research approaches, significance of research, research methods and methodology, research process, research and scientific methods, criteria of good research, review of literature-purpose of the review, sources of the review, preparation of index card for reviewing and abstracting.

**Problem Identification and Hypothesis Formation** - Problem- meaning and characteristics of a problem, types of problem, generality and specificity of problem; hypothesis- meaning and characteristics of a good hypothesis, types of hypotheses, formulating a hypothesis, ways of stating a hypothesis; testing experimental hypothesis- standard error, test of significance, level of significance, degrees of freedom, errors in hypothesis.

**Sampling and Research Design** - Meaning and types of sampling; probability and non probability sampling. methods of drawing samples, requisites of a good sampling method, sample size, sampling error; meaning and purpose of research design, types of research design, criteria of a good research design, basic principles of experimental design.

**Measurement and Scaling Techniques** - Measurement in research, measurement scales sources of errors in measurement, tests of second measurement, techniques of developing measurement tools, meaning of scaling, scale classification bases, important scaling techniques, and scale construction techniques.

**Data Collection, Processing and Analysis** - Methods of data collection – primary data, secondary data; primary data collection – observation method, interview method, questionnaires, schedules, guideline for constructing questionnaires/schedules, secondary data collection of, selection of appropriate method of data collection; coding, editing and tabulation of data, charts and diagrams used in data analysis, bar and pie diagrams and their significance; measures of central tendency, measures of dispersion; correlation and regression analysis - meaning and uses, methods of calculation of coefficients and their analysis and implication. sampling distribution, sampling schemes and sample sizes, hypothesis testing,

test of hypothesis for the population mean, population variance and ratio of two population

variances; applications of z-test, t-test, f-test and chi-square test, association of attributes and techniques of testing, ANOVA.

**Optimization and Factorial Design** - Definition, need, advantages, meaning of general terms involved in optimization process. Classification of optimization methods. Basic understanding with at least one example of following optimization techniques:-Simplex method, Lagrangian method, EVOP, Grid search method. 2k and 3k factorial designs.

**Regression Analysis** - Simple and multiple linear regression and hypothesis testing; response surface methodology-the method of steepest ascent: response surface designs for first-order and second-order models. Evolutionary operation (EVOP)

**Ethics** - Environmental impacts, ethics issues, ethical committees, commercialization, copyright, royalty, IPR and patent law. Reproduction of published material-plagiarism, citation and acknowledgement.

**Report Writing** - meaning and significance of report writing, types of report, steps in writing report, layout of the research report, precaution in writing research report, developing thesis report, formatting, inside citations, references and bibliography, knowledge of computer-MS office, MS-Word, excel and power point, statistical software and their application, application of statistical tests/techniques through the use of statistical software like SPSS, SYSTAT for documentation, report generation and importance of effective communication.

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	All Discipline	<b>Contact Hours</b>	30
<b>Subject Name</b>	Research and Publication Ethics	<b>Subject Code</b>	CPE-RPE002

**Course Content**

**THEORY**

**RPE 01: PHILOSOPHY AND ETHICS**

1. Introduction to philosophy: definition, Nature and scope, concept, branches
2. Ethics: definition, moral philosophy, nature of moral judgments and reactions

**RPE 02: SCIENTIFIC CONDUCT**

1. Ethics with respect to science and research
2. Intellectual honesty and Research integrity
3. Scientific misconduct: falsification, fabrication and plagiarism (FFP)
4. Redundant Publications: duplicate and overlapping Publications, Salami slicing
5. Selective reporting and misrepresentation of data

**RPE 03: PUBLICATION ETHICS**

1. Publication ethics: definition, introduction and importance
2. Best practices/ standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflict of interest
4. Publication misconduct: definition, concept, problems that lead to unethical behavior and vice-versa, types
5. Violations of Publication ethics, authorship and contributionship
6. Identification of Publication misconduct, complaints and appeals
7. Predatory publishers and journals

**PRACTICE**

**RPE 04: OPEN ACCESS PUBLISHING**

1. Open access publications and initiatives
2. SHERPA/RoMEO online resource to check publisher copyright and self-achieving policies
3. Software tool to identify predatory publications developed by SPPU
4. Journal finder/ journal suggestions tools viz. JANE, Elsevier Journal finder, Springer journal Suggester, etc.

**RPE 05: PUBLICATION MISCONDUCT**

**A. Group Discussions**

1. Subject specific ethical issues, FFP, authorship
2. Conflict of interest
3. Complaint and appeals: examples and fraud from India and abroad

**B. Software Tools**

Use of plagiarism software like Turnitin, Urkund and other open source software tools

**RPE 06: DATABASE AND RESEARCH METRICS**

**A. Databases**

Indexing database

Citation databases: Web of science, scopus, etc.

**B. Research metrics**

Impact factor of journal as per Journal Citation Reports, SNIP, SJR, IPP, Cite score

Metrics: h- index, g index, i10 index, altmetrics

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Biotechnology	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Biotechnology	<b>Subject Code</b>	PHD102BT01

### Course Content

Introduction and Applications of following:

Enzymes for industry/ Medicine, Immobilized enzyme technology, designer enzymes – Biosensors

Molecular Farming, Edible Vaccines, Therapeutics from Transgenic Plants, Bio- Degradable Plastics, Molecular Markers, RAPD, RFLP, AFLP Techniques,

Plant Cell culture and production of Secondary metabolites

Animal cell culture Techniques, Gene Therapy, Stem Cells in Therapeutics, Oncogenes, Tumor suppressor Genes & Cancer Biology, AIDS & other Immuno- deficiencies

Characterization and production of Recombinant Therapeutic proteins, Bioinformatics & Computer aided Drug Designing

Biopesticides in integrated pest management

Bioremediation of contaminated soils and waste land. Waste Management strategies

Bio-Energy, Bio-Diesel: Tree borne and Algal oils and Trans-esterification, Hydrogen and Electricity from Microbes

Biosafety in relation to recombinant organisms & transgenic research applications, Social and ethical issues.

Process Economics, Cost Analysis and Investment Decisions.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Botany	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Plant Science	<b>Subject Code</b>	PHD102BN01

### Course Content

Microbial Biotechnology

- i) Bioremediation
- ii) Biofertilizers (Cyanobacteria, Bacteria and Mycorrhizae)
- iii) Phycotoxins and Mycotoxins
- iv) Role of soil microbes in the degradation of pesticides and polycyclic aromatic hydrocarbons (PAHs)

Plant pathology–Principles of plant disease development, disease control (chemical, biological and integrated disease management) and role of biotechnology in plant disease control.

Molecular Plant Pathology – Host pathogen interactions; Recognition; Defense Elicitors, phytoalexins, Plant Immunization.

Signal perception and transduction. Introduction, Receptors, G proteins, Phospholipid signaling, Cyclic nucleotides, Calcium calmodulin, protein kinases

Heavy metal stress: Availability, physiological basis for toxicity – water relation, photosynthesis, oxidative damage, membrane perturbations, tolerance mechanism – phytochelatin, phytoremediation – phytofiltration, phytoextraction, Phytostabilization, prospects and limitations

Isolation and characterization of certain enzymes (Rubisco, PEP Carboxylase, GS and GOGAT)

Regulation of photorespiration and its significance in crop, productivity

In vitro production of secondary metabolites. Significance of Hairy roots

The origin and early evolution of angiosperms, with reference to recent findings on fossil pollen, flowers and leaf remains.

Identification of Gymnosperms and Dicot wood based on anatomical characters of wood.

Concept of ICBN and salient features of Botanical nomenclature. i. Typification ii. Rules of priority

- iii. Effective and valid publication
- iv. Authors citations

Cultivation, harvest, drying, grading, packing, storage and marketing of medicinal plants

Pharmacognostic study of different types of plant drugs with special reference to Aromatic plants–Lemongrass and Palmarosa: Medicinal plants i) Aloe vera ii) Glory lily

Indigenous traditional drugs of India and their market Adulteration

Conventional plant breeding, mutation breeding, QTL mapping and Marker assisted selection for crop improvement.

Tissue culture of plants: Callus culture, plantlet regeneration, micro propagation, somaclonal variation and synthetic seeds.

Principles of genetic engineering and status of transgenic plants.

Molecular characterization of Elite medicinal plants and endangered plants and development of molecular markers (RAPD, SSR and AFLP).

Biodiversity-Types, hot spots, threats to Biodiversity and conservation.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Chemistry	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Instrumental Methods of Analysis in Chemistry	<b>Subject Code</b>	PHD102CH01

### Course Content

#### Spectroscopic Methods

General principles, Instrumentation and applications of the following spectroscopic techniques. Infrared Spectroscopy (IR), Roman Spectroscopy, nuclear Magnetic Spectroscopy (NMR), Electron Spin Resonance (ESR), Mossbauer Spectroscopy, Nuclear Quadraupole Resonance (NQR) Spectroscopy, Fluorescence Spectroscopy, Atomic Absorption Spectroscopy (AAS), Atomic Emission spectroscopy (AES), Inductively Coupled Plasma Atomic Emission spectroscopy, UV/Visible Spectroscopy and Mass Spectroscopy.

#### Surface Analysis

Principles, instrumentation and applications of Auger Electron Spectroscopy, Secondary Ion Mass spectroscopy (SIMS), X-ray Photoelectron Spectroscopy (XPS)

#### Microscopic Techniques

Working Principle, instrumentation and applications of Atomic Force Microscopy (AFM), Optical microscopy, Polarizing Optical Microscopy, Interference Microscopy, Fluorescence Microscopy, Scanning Probe Microscopy (SPM), Scanning Tunneling Microscopy (STM), Transmission Electron Microscopy (TEM), Techniques of preparing samples for microscopy, Fourier Transformation in Microscopy.

#### Thermal Analysis:

Principles, instrumentation and applications of Differential Scanning calorimetry (DSC), Thermo Mechanical Analysis (TMA), Thermo gravimetric Analysis (TGA), Dynamic Mechanical Spectroscopy (DMS), Differential Thermal Analysis (DTA), Dielectric Thermal Analysis (DETA), Thermal Conductivity, Thermal Diffusivity, Effusivity

#### Chromotographic Techniques

Principles, Instrumentation (basic components) and applications of gas chromatography, High Performance Liquid Chromatography (HPLC), Ion Exchange Chromatography: Size Exclusion Chromatography, Thin Layer Chromatography, Inverse Gas Chromatography.

#### Scattering Techniques;



Principles, Instrumentation (basic components) and application of X ray Diffraction (XRD) technique SAXS and WAXD, Dynamic and Static Light Scattering, SALS, Turbidimetry, Nephelometry and small angle neutron scattering techniques. MOLECULAR WEIGHT DETERMINATION

Principles, Instrumentation (basic components) and application of Osmometric Techniques - Vapour Pressure Techniques (VPO), membrane Osmometry (MO), Differential Refractometry and Light Scattering techniques.

Dielectric Spectroscopy/Impedance Spectroscopy

Principles, Instrumentation (basic components) and application Surface Resistivity, Dielectric Spectroscopy/Impedance Spectroscopy, Volume Resistivity, Dielectric Loss, Arc Resistivity.

Mechanical and Viscoelastic Characterization

Properties of materials in tension, compression, bending, torsion, flexural modes, Static mechanical properties, Dynamic properties, creep, stress relaxation and dynamic mechanical properties. Flow/Rheological Characterization Viscosity determination, capillary rheometer, rotational rheometer, different types of viscometers

Optical Characterization

Haze, Gloss, Transparency, Scattering, color, luster, streak, index of refraction, dispersion, luminescence, fluorescence.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Engineering	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Civil Engineering	<b>Subject Code</b>	PHD102CE01

### Course Content

Stones : Occurrence, varieties, Characteristics and their testing, uses, quarrying and dressing of stones. Timber : Important timbers, their engineering properties and uses, defects in timber, seasoning and treatment, need for wood substitutes, Alternate materials for shuttering doors/windows, Partitions and structural members etc. Brick and Tiles: Manufacturing, characteristics, Classification and uses, Improved brick from inferior soils, Hand molding brick table, Clay-fly ash brick table, Flooring tiles and other tiles and their characteristics. Advance Construction Materials : Use of fly ash in mortars, concrete, Fly ash bricks, stabilized mud blocks, non-erodible mud plinth, D.P.C. materials, Building materials made by Industrial & agricultural waste, clay products P.V.C. materials, advance materials for flooring, doors & windows, facia material, interiors materials for plumbing, sanitation & electrification.

Introduction Classification, properties, grades, advantage & disadvantages of concrete, Ingredients of concrete, types of cement, aggregates, water, admixtures, Inspection & testing of materials as per Indian Standard Specifications. Properties of Fresh and Hardened Concrete : Introduction, Workability, Testing of concrete, Factors affecting, Rheology of concrete, Compressive & Tensile strength, Stress and strain characteristics, Shrinkage and temperature effects. Creep of concrete, Permeability, durability, thermal properties & micro-cracking of concrete.

Design of Concrete Mix : Various classical methods of concrete mix design, I.S. code method, basic considerations and factors influencing the choice of mix design, acceptance criteria for concrete, concrete mixes with Surkhi and other Pozzolanic materials, design of plastic concrete mix, computer aided design of concrete. Quality Control

High way planning, Alignment & Geometric Design: Principles of highway planning, road planning in India and financing of roads, classification patterns. Requirements, Engg. Surveys for highway location. Cross sectional elements- width, camber, super-elevation, sight distances, extra widening at curves, horizontal and vertical curves, numerical problems. Bituminous & Cement Concrete Payments: Design of flexible pavements, design of mixes and stability, WBM, WMM, BM, IBM, surface dressing, interfacial treatment- seal coat, tack coat, prime coat, wearing coats,

grouted macadam, bituminous concrete specification, construction and maintenance. Advantages and disadvantages of rigid pavements, general principles of design, types, construction, maintenance and joints, dowel bars, tie bars. Brief study of recent developments in cement concrete pavement design, fatigue and reliability.

Low Cost Roads, Drainage of Roads, Traffic Engg. & Transportation Planning: Principles of stabilization, mechanical stabilization, requirements, advantages, disadvantages and uses, quality control, macadam roadstypes, specifications, construction, maintenance and causes of failures. Surface and sub-surface drainage, highway materials: properties and testing etc. Channelised and unchannelised intersections, at grade & grade separated intersections, description, rotary-design elements, advantages and disadvantages, marking, signs and signals, street lighting. Principles of planning, inventories, trip generation, trip distribution, model split, traffic assignment, plan preparation.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Commerce	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Recent Trends in Commerce & Management	<b>Subject Code</b>	PHD102CM01

### Course Content

Recent Trends in Business Environment:

- a) Liberalization, Privatization and Globalization [LPG]: Environmental changes in business- SWOT analysis, Role & performance of WTO in changing economic environment, Management change, Adaptability for success,
- b) Liberalization: structural reforms de-regulation.
- c) Privatization: change in the top management of public sector, disinvestment of public enterprises and entry into MOUs & Navaratnas,
- d) Globalization: integrating the Indian economy into the global economy, Free Trade Areas (FTAs)

Recent Trends in Management.

- a) Recent trends in management practices: Total quality management (TQM), six- sigma, Basic concept of ISO, Bench marking, corporate social responsibility.
- b) Recent Trends in legal environment: Legal environment relating to business, Features of Consumer Protection Act, Restrictive Trade Practices, MTP, Unfair trade Practices (UTP), IPR, TRIMS, GATS, FEMA.
- c) Recent trends in Marketing: Concept of services marketing, 7 P's (Product , Price, Place, Promotion, People, Physical evidence & procedure ), Customer relationship management (CRM), supply chain management, logistics management, concept of mega marketing.
- d) Recent trends in Human Resource Management: HRM in perspective, Human resource requirement, Developing effectiveness, compensation and security, employee relations, strategic Human Resource Management and performance appraisal.

Recent Trends in Accounting & Finance:

- a) Recent Trends in Accounting: IFRS including International Accounting standards (Broad understanding of concepts is expected), Accounting for intangibles, Environmental Accounting and auditing, Forensic Accounting, Balanced scorecard.
- b) Recent trends in Finance- Portfolio management, security analysis, changes in capital market, Role of national level stock exchanges, Derivatives- Concept, New financial instruments, securitization of loans and risk management, Role of credit rating agencies including CRISIL & CRIEDA, Commodity markets.
- c) Recent trends in Banking and Financial Institutions: E- Banking, Core Banking, ATM, RTGS, Private Banking, Global Banking, IFC, SFCs, IDBI, SIDBI, EXIM Bank and regulatory agencies like SEBI, IRDA and recent trends in Central Banking.

Recent Trends in Information Technology and E- Commerce:

Concept of IT & E-commerce, scope of IT & E-commerce, Types of E-commerce Practices, Concept

of Business process outsourcing, knowledge process outsourcing.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Computer Science & Applications	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Computer Science & Applications	<b>Subject Code</b>	PHD102CA01

### Course Content

**Digital Logic:** Number system, Information representation, Computer arithmetic on fixed & floating point numbers, Boolean algebra, Combinational circuits, sequential circuits, Memory system, Processor organization, Input-output organization, pipe-line processing, static & dynamic interconnection networks.

**Programming Languages:** Paradigms, Data types, operations, Expressions, Control structures, I/O statements, Parameter parsing techniques. Language constructs for object-oriented, functional, logic & concurrent programming, Chomsky hierarchy of formal languages, finite automata & pushdown automata.

**Optimization & Simulation Tools:** Linear Programming: LPP in the standard form, canonical forms, conversion in standard form, Simplex prevention of cyclic computations in Simplex & Tableau, Big-M method, Dual Simplex & revised simplex.

**Simulation:** Analog vs. Digital simulation, Continuous & discrete system simulation, Simulation of Hypothetical Computer, Inventory system & Corporate system, simulation of PERT, Generation of uniform & Non- uniform random number, Monte Carlo method, Design of experiment, simulation languages.

**Software Engineering:** Development models, Metrics, Software Project Management, Analysis, Design: System design, detailed design, function-oriented, Object-oriented analysis & design, user interface design, Coding & Testing, Software quality & reliability, Object Modeling Technique (OMT) methodology.

**Computer Graphics:** Components of an Interactive Graphics system, Display systems, Input/output & storage devices, 2D geometry, Graphic operations, 3D Graphics, Animation, Graphic standards, Application Concepts, Projections and Hidden surface elimination.

**Computer Networks:** Fundamentals, Reference Models, Data Communication, Internetworking: Components and issues; Media access controls, virtual circuits & datagrams, Routing algorithm, Congestion control, Network Security, Firewalls, Internet architecture and protocols.

**Data Base:** Basic concepts, Characteristics of Database approach, Three-schema Architecture and Data Independence, Data Models, E-R Model, Relational Data Model, SQL Programming Techniques,

Relational Database Design, Functional Dependencies, Normalization, Query Processing and Optimization, Transaction Processing Concepts, Concurrency Control Techniques and Recovery Techniques

Enhanced Data Models for Advanced Applications, Distributed Database and Client-Server Architectures. Overview of Data Warehousing and OLAP, Data Mining Concepts

Emerging Database Technologies and Applications.

**Data Structure:** Arrays, String, Linked Lists - Singly, doubly & Circular List; Stacks, Queues, Priority Queues: Representation & Manipulation; Trees: Binary & Threaded Trees, traversal, Binary Search Tree, Huffman & AVL Trees, B Trees; Graphs: Adjacency Matrix, Path Matrix, Linked Representation, traversal; Searching & Sorting techniques..

**Operating System:** Functions, Multiprogramming, Multiprocessing & Multitasking, Memory Management, Virtual memory, Paging, Fragmentation. Concurrent Processing: Mutual exclusion, Critical regions, lock & unlock. Scheduling: CPU scheduling, I/O scheduling, Deadlock: avoidance & prevention; UNIX: Structure & commands of UNIX, Interfacing with UNIX, Editors & Compilers for UNIX, LEX & YACC, File system, System calls, Filters, Shell Programming.

**System Programming:** Assembly language fundamentals, Assemblers - 2 pass & single pass, Macros & Macro processors. Loading, Linking, relocation, program relocatability, linkage editing, Text editors, Programming Environments, Debuggers & program generation. Compilation & interpretation, Bootstrap compiler, Phase of compilation - lexical & syntax analysis, storage allocation, code optimization & generation.

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Computer Science and Engineering	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Computer Science and Engineering	<b>Subject Code</b>	PHD102CS01

### Course Content

#### **Data Mining and Data Warehousing**

Advanced Database Technologies, Fundamentals of data warehousing and data mining Data Warehousing Architectures, Data mining Techniques

#### **Web Technologies and Services**

Web Application Architectures, E-Payments Gateways and Mechanism E-Governance Systems, E-Learning Systems

#### **Software Technologies**

Programming Paradigms and Platforms, Service Oriented Architectures Software, Quality Assurance Software Testing, Knowledge Management and Intelligent Systems, Enterprise Application Integration: ERP Applications

#### **Hardware and Networking Technologies**

Processor Architectures, Operating Systems, Embedded Systems Networking Technologies, Next Generation Heterogeneous Networks



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Economics	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Economics	<b>Subject Code</b>	PHD102CM02

### Course Content

Economics of Information – Informational Asymmetries and adverse selection, Principal Agent Frame work, Moral Hazard, Hidden Action Modelling, Adverse Selection in Markets, Efficiency wage model. Dynamic Issues in Economics, Intertemporal Choice-Intertemporal production- Introduction to chaos theory, some economic models with chaos

Post Keynesian Economics - Review of Hicks , Hansen, Patinkin, Synthesis of Keynesian model, Monetarism, Portfolio Theory and theory of Financial Markets- Disequilibrium in economic Theory, Adjustment by Price or quality- Neo-classical Macroeconomics, New Classical Economics, Rational expectations and Public Policy- New-Keynesian economics- Endogenous Growth Theories.

Developments in International Trade Theory - Paul Krugman's contribution and further developments. Theories of Finance- Recent theories in Risk Management, Financial Inclusion, Changing role of financial institutions, Dependency Theory and Underdevelopment, New Institutional Economics

Contemporary economic Policies in India- Global Recession and its impact on India Economy-Policy framework adopted in India, Infrastructural Development- Environmental Issues and Global Warming in the Indian Context- Pigovian taxes – taxable permits and tradable permits in the Indian context, Externalities and its measurement, Inflation Targeting and monetary policy in India- Interfaces of Monetary and Fiscal policy in India- FDI in Retail and Insurance- Recent Employment Generation Programmes and Social Safety net works in India. Common Property Resources Issues in India

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Education	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Education	<b>Subject Code</b>	PHD102ED01

**Course Content**

Educational Philosophy

1. Relation of Education and Philosophy
2. Western Schools of Philosophy: Idealism, Realism , Naturalism, Pragmatism, Existentialism
3. Indian Schools of Philosophy: Vedanta, Buddhism ,Jainism , Islamic
4. Contributions of Swami Vivekanand , Mahatma Gandhi, Ravindranath Tagore, Shree Aurbindo to Educational Thinking

Sociological Foundations of Education

1. Relationship of Sociology and Education ,Meaning and Nature of Educational Sociology
2. Meaning and Nature of Social Change and Social Mobility
3. Education as Related to Social Equity and Equality of Educational Opportunities
4. Constraints on Social Change in India (caste, ethnicity, class, language, religion, regionalism)

Psychological Foundations of Education

1. Relationship of Education and Psychology and Concept of Educational Psychology
2. Process of Growth and Development
  - Physical, social, emotional and intellectual
  - Individual Differences- determinants, role of heredity and environment, implications of individual differences for organizing educational programmes
3. Personality : Types and trait theories ,Measurement of Personality
4. Mental Health and Hygiene: Process of adjustment, Conflicts and Defence mechanism, Mental Health,

Educational Measurement and Evaluation

1. Educational Measurement : Concept ,Scope , Need
2. Tools of Measurement and Evaluation: Essay type test, Objective test, Scales, Questionnaires, Inventories, Performance test,
3. Steps in the Standardization of test and Characteristics of a Good Measuring Instrument (i.e. Validity, Reliability, Norms, Usability)
4. Measurement of Achievement, Aptitudes, and Attitudes

Educational Technology

1. Meaning and scope of educational Technology, System Approach ,components of educational Technology(Hardware and software)
2. Communication Process: Concept of Communication, Modes and barriers of Communication, Class room Communication
3. Modification of Teaching Behaviour : Micro teaching, Simulation ,Flander's Interaction Analysis
4. Instructional Strategies: Lecture, Team teaching , Discussion , Seminars and Tutorials

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Engineering	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Electrical Engineering	<b>Subject Code</b>	PHD102EE01

### Course Content

Protective Relays: Relaying review, characteristics and operating equations of relays. CT's and PT's differential relay, over-current relay, reverse power relay, distance relays, applications of relays.

Induction Machine: Voltage, torque equation for steady state operation, Equivalent circuit, Dynamic performance during sudden changes in load torque and three phase fault at the machine terminals. Voltage & torque equation for steady state, Operation of 1- $\phi$  induction motor & scharge motor

Power System components models formation of bus admittance matrix, algorithm for formation of bus impedance matrix. Reactive power capability of an alternator, transmission line model & load ability, Reactive power transmission & associated difficulties, Regulated shunt compensation, Models of OLTC & Phase shifting transformer, load flow study.

Understanding Power quality, types of power quality disturbances, power quality indices, Causes and effects of power quality disturbances

Square wave permanent magnet brushless dc motor, magnetic circuit analysis on open circuit torque & emf equations, torque speed characteristics, efficiency, commutation, winding inductances, armature reaction and controllers.

D.C. Drive, speed torque, speed control. Starting, Breaking. Controlled rectified fed DC drive, chopper controlled dc drives. Close loop control of d.c. drive. Introduction of transient analysis.

Flexible ac transmission system, reactive power control, brief description and definition of FACT's controllers, shunt compensators, configuration and operating characteristics of TCR, FC-TCR, TSC, Comparisons of SVCs.

Basic concepts and definitions: Rotor angle stability, voltage stability and voltage collapse, Midterm and long-term stability, Classification of stability, states of operation and system security system dynamic problems.

Analysis and Design of FACTS based stabilizers: Analysis of damping torque contribution by FACTS based stabilizers installed in SMIB systems, Design of robust FACTS based stabilizers installed in SMIB systems by phase compensation method. Selection of installing locations and feedback signal for FACTS based stabilizers.

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Electronic and Communication Engineering	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Electronic and Communication Engineering	<b>Subject Code</b>	PHD102EC01

**Course Content**

**Embedded system-** definition, Types of processors used; Peculiarities and specialties; Requirement and Application, Application Domain of Embedded Systems, Desirable Features and General Characteristics of Embedded Systems, Model of an Embedded System, Microprocessor vs Microcontroller, Example of a Simple Embedded System , Figures of Merit for an Embedded System, Classification of MCUs: 4/8/16/32 Bits, History of Embedded Systems, Current Trends.

**Processors and microcontrollers for embedded systems**

Brief review of 8085, 8051, 8086, 80386, PIC processors and ARM based processor. Microcontroller Unit (MCU), A Popular 8-bit MCU, Memory for Embedded Systems, Low Power Design, Pull up and Pull down Resistors

**Operating systems for embedded systems**

Need for an operating system; Different types like single user and tasking, multi user, multi-tasking, time sharing, batch processing, real time; Micro kernel vs. monolithic; Major functions-Process management, Memory management, File system Management, I/O management and Network management.; Concept of process, threads, task switching, scheduling, critical sections, deadlock.

**Real time operating systems Issues**

I/O programming- Synchronization, transfer rate and latency. Polled I/O issues. Interrupt driven I / O; ISR; Response time- interrupt controller; Software interrupts and exceptions; Buffering of data and queuing of interrupt request; Concurrency control-Foreground /Background systems; Thread state and serialization, latency, prevention of interrupt overruns; Concurrent execution of threads, context switch, non-preemptive multitasking, preemptive multitasking; Critical sections:- disabling interrupts, disabling ask switch, spin lock, semaphore. Real-time Tasks, Real-time Systems , Types of Real-time Tasks , Real-time Operating Systems, Real-time Scheduling Algorithms, Rate Monotonic Algorithm, The Earliest Deadline First , Algorithm, Qualities of a Good RTOS.

**Scheduling in embedded systems**

Conventional scheduling, deadline driven scheduling, rate monotonic scheduling, deadlock, watchdog timer; Memory management in embedded systems- Static allocation, dynamic allocation; Recursion and dynamic allocation; shared memory, re-entrant functions; Boot up and System initialization. 8086 microprocessor with a C compiler (suited for RTOS) and uC / OS RTOS; Real time Embedded System applications as case study.

**Software Development Tools**

Embedded Program Development, Downloading the Hex File to the Non-volatile Memory, Hardware Simulator

**Sensors, ADCs and Actuators**

Sensors, Analog to Digital Converters, Actuators

**Buses and Protocols**

Defining Buses and Protocols, On-board Buses for Embedded Systems, External Buses Automotive Buses, Wireless Communications Protocols

**Examples of Embedded Systems**

Mobile Phone, Automotive Electronics, Radio Frequency Identification (RFID), Wireless Sensor Networks (WISENET), Robotics , Biomedical Applications, Brain Machine Interface

**Programming in Embedded System**

Brief about Embedded System

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	English	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- English	<b>Subject Code</b>	PHD102EN01

### Course Content

History of English Literature: 14<sup>th</sup> century to Present Day. ( All major authors and their works.)

History of Indian Writing in English. (All major authors and their works.)

History of Indian English Literature. (All major authors and their works.)

Linguistic techniques , Grammar and their usage.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Environmental Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Environmental Sciences	<b>Subject Code</b>	PHD102ES01

### Course Content

#### Earth and Environment

Earth as a System of Interacting Components, Materials of the earth, Lithosphere, Atmosphere, Hydrosphere and Biosphere, Hydrologic cycle and groundwater, Hydrogeology and Geology.

Introduction, Ecosystems, Biodiversity and its significance, Biogeography of India, Critical ecosystems and landscape-level conservation, Laws and Policies of Govt. of India for biodiversity conservation.

Case studies: Biodiversity of Western Ghats, Human-Animal Conflict and resource sharing, Participatory forest management.

#### Environment Management

Environment Management: Principles, tools-EIA, LCA, Environment audit, Environment Management Systems, Environmental Planning and Management. Case studies – EIA

Resource Conservation – Renewable and non-renewable resources, Tools for the management of natural resources. Conservation strategies – policies and laws of GOI. Disaster management – case studies

#### Environmental Chemistry

Chemistry and environment (fundamentals), Thermodynamics (concepts of first and second laws in environment), fundamentals of green chemistry, Atmospheric chemistry, Air, Water and soil pollution, Ecotoxicology, Toxicity of metals, pesticides, radioactive minerals, fluorides etc, Interaction of toxicants with environment, bioaccumulation and magnification, biomarkers, Role of microbes in biogeochemical cycles, Water treatment, recent advances in water purification, Case studies-air pollution, water pollution, soil pollution.

#### Analytical Techniques and Instrumentation

Chromatographic techniques, TLC, GC, HPLC, GC-MS, LC-MS, Electrophoresis, Microscopy, Fluorescence microscopy, SEM, AFM, TEM, Basics and applications of spectroscopy, UV, IR, Raman, NMR, AAS.

Remote sensing & GIS: Mapping concepts: Satellite remote sensing – EMR, platforms, sensors, visual

interpretation and elements, digital image processing; Aerial photography; Global positioning system; Geographic Information System – components, data structures, spatial analysis and modelling; applications in environment science and management.

Environmental Biotechnology and Waste Management: an overview, Biotechnological solutions to Environmental Pollution, Air, Water and Soil, Emerging trends in –Agro biotechnology, Ecological Engineering, Biodegradable plastics, Biotechnological methods in solid waste management, processing/treatment of hazardous wastes.



<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Genetics	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Genetics	<b>Subject Code</b>	PHD102GE01

**Course Content**

**General Principles of gene cloning:** Isolation and purification of DNA RFLP Analysis DNA fingerprinting and its application Principles and techniques of nucleic Acid hybridization and cot curves, sequencing of nucleic acid, Southern, Northern and western blotting techniques preparation of probes polymerase Chain reaction, RT-PCR, Methods for nucleic acid and protein interaction.

**Biophysical methods:** Analysis of biomolecules using UV/ Visible, fluorescence, Circular dichroism NMR and ESR Spectroscopy, crystallography, structure determination using X-ray diffraction and NMR, Different types of mass spectrometry and surface plasma resonance methods Protein sequencing.

**Bio separation technique:** Principle and application of gel filtration ion exchange and hydrophobic interaction chromatography thin layer chromatography gas chromatography high pressure liquid chromatography Fast protein liquid chromatography electrophoresis agarose and page isoelectric focusing IEF Ultracentrifugation Velocity and buoyant density

**Radio labeling techniques:** Properties of different types of radioisotopes normally used in biology their detection and measurement incorporation of radioisotopes in biological tissues and cells molecule imaging of radioactive material safety guidelines

**Computational methods:** Nucleic acid and protein sequence databases data mining methods for sequence analysis web based tools for sequence searches motif analysis and presentation.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Geography	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Geography	<b>Subject Code</b>	PHD102GG01

### Course Content

**Climatology** : Climatology & Meteorology, Basic principles of climatology, atmosphere, stability & instability of atmosphere, climatic classification, cyclones, anticyclones, Climate change, Monsoons, weather hazards and techniques in climatology.

**Geomorphology**: Paradigms in Geomorphology, concepts, Approaches and modes in Geomorphology and techniques in Geomorphology

**Economic Geography** : Pre capitalist world, the rise and spread of capitalism, resources and Development, Globalizations, theories and strategies of development

Agricultural regionalization, Agricultural Productivity, Land use surveys, Land classification, models in Agricultural Geography, food security, Transport Network models, Industrial location Theories of industries

**Settlement and Population Geography**: Paradigms in Population and Settlement Geography, Concepts, approaches and modes in Population and settlement Geography, Techniques / measures in population and settlement Geography.

Influence of Geographical environment on Major Indian tribes. Namely SANTAL, NAGAS, GONDS, GUJJARS and BHILLS. Habitat settlement pattern, food habits, dress code occupation, cultural activities.

**Introduction of coastal geomorphology** : coastal erosion- movement of materials; sorting; beach profile; coastal land forms- sand dunes ad sand ridges, spits, barriers, lagoon, cliffs- their origin and distribution on Indian coastal area.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Law	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Law	<b>Subject Code</b>	PHD102LW01

### Course Content

Law and Social Change, Law as an instrument of social change, Law as the product of traditions and culture. Critic and evaluation in the light of colonization and the introduction of common law system and institution in India and its impact on further development of law and legal institutions in India. Religion and the Law, Religion as a diverse factor, Secularism as a solution to the problem, Reform of the law on secular lines: problem. Freedom of religion and non-discrimination on the basis of religion. Religion minorities and law. Language and the Law, Language as a diverse factor: formation of linguistic states. Constitutional guarantees to linguistic minorities, Language policy and the Constitution: Official Language; multi- language system. Non- discrimination on the grounds of language, Community and the Law, Caste as a divisive factor Non- Discrimination on the grounds of Caste. Acceptance of caste as a factor to undo past injustices. Protective discrimination: Scheduled caste, tribes and backward classes. Reservations; Statutory Commissions, Statutory provisions. Regionalism and the law Regionalism as a divisive factor Concept of India as one unit. Right of movement, residence and business; impermissibility of state or regional barrier. Equality in matters of employment: the slogan “Sons of the soil” and its practice. Admission to educational institutions: preference to residence of a state.

Women and Law, Crimes against women, Gender injustice and its various forms Women’s Commission. Employment of women: Constitutional and other legal provisions Children and the Law. Child Labour Sexual Exploitation Adoption and related problems. Children and education. Modernisation and the law Modernisation as a value: Constitutional perspectives reflected in the fundamental duties. Modernisations of social institution through law. Reform of family law. Agrarian reform- Industrialisation of agriculture Industrial reform: Free enterprise v. State regulation- Industrialisation v Environmental protection. Reform of court processes Criminal law: Plea bargaining; compounding and payment of compensation to victims. Civil Law: (ADR) Confrontation v. consensus; mediation and conciliation; Lokadalats.

Prison Reforms. Democratic decentralisations and local self- government.

Alternative approaches to Law.

The jurisprudence of Sarvodaya- Gandhiji, VinodaBhave, Jayaprakash Narayan. Surrender of dacoits; concept of gramanyayalayas. Socialist thought on law and justice: An enquiry through constitutional

debate on right to property. Indian Marxist critique of law and justice. Naxalite movement: cause and cure.

Federalism, Creations of new states, Allocation and share of resources – distribution of grants in aid  
The inter-state dispute in resources Rehabilitation of internally displaced persons. Centre's responsibility and internal disturbance within states Directions of the Centre to the state under Article 356 and 365 Federal Comity: Relationship of trust and faith between Centre and State Special status of certain states Tribal areas , Schedule Caste.

“State”: Need for widening the definition in the wake of liberalisation. Right to Equality: Privatisation and its impact on affirmative action. Empowerment of women.

Freedom of press and challenges of new scientific development. Freedom of speech and right to broadcast and telecast. Right to strike, hartal and Bandh. Emerging regime of new rights and remedies. Reading regime principles and fundamental Duties into Fundamental Rights Compensation jurisprudence Right to Education.Commercialization of education and its impact. Brain drain by foreign education market. Right of minorities to establish and administer educational institution and state control.

Separation of powers: stress and strain. Judicial activism and judicial restraint. PIL: implementation. Judicial Independence. Appointment transfer and removal of judges. Accountability : executive and judiciary. Tribunals.

Democratic process. Nexus of politics wit criminals and the business. Election. Election commission: status Electoral Reforms. Coalition government, „stability, durability, corrupt practice“ Grass root democracy.

Nature of judicial process: Judicial process as an instrument of social ordering, Judicial process and creativity in law – common law model – Legal Reasoning andgrowth of law- change and stability. The tools and technique of judicial creativity stability. Legal development and creativity through legal reasoning under statutory and codifiedsystems.

Special dimensions of judicial process in constitutional Adjudications. Notions of judicial Review.

Judicial Process in India. Indian debate on the role of judges and on the notion of judicial review. Institutional liability of courts and judicial activism- scope and limits.

The Concept of justice. The concept of justice or Dharma Indian Thought. Dharam as the foundation of legal ordering in India Thought. The concept and various theories of justice in the western thought. Various theoretical bases of justice: the liberal contractual tradition, the liberal utilitarianand the

liberal moral tradition.

Relation between law and justice: Equivalence Theories- Justice as nothing more than the positive law of the stronger class. Dependency theories- For its realisation justice depends on law, but justice is not the same as law. The independence of justice theories – means to end relationship of law and justice – The relationship in the context of the Indian constitutional ordering. Analysis of selected cases of the supreme court where the judicial process can be seen as influenced by theories of justice.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Management	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Human Resource Management	<b>Subject Code</b>	PHD102MG01

### Course Content

**Introduction:** Concept, Objectives, Scope, Functions; Human Resource Planning - Importance and Process; Recruitment and Selection - Different method of Recruitment; Process of Selection; Training and Development – Different methods Industrial Relations- Different Approaches; Three Actors of IR

**International Human Resource Management:** Concept Difference between International Human Resource Management and Domestic HRM; Different approaches of International HRM; Industrial Relations in MNCS; Virtual

Organisations - Concept; Difference between Virtual Organisation and Traditional Organisation ; Types, Merits and Demerits of Virtual Organisation. International Resruiement and selection Crieteria ; International Compensation

**Strategic Human Resource Management:** Concept, Difference between Strategic HRM and Traditional HRM S-p Model of Strategic HRM ; Factors Influencing HR Strategies ; Changing environment of HRM- Globalisation, Technological development, nature of Work, Exporting jobs, work force demographics ; Strategic Management Process Role of HR, Traslating Strategy into HR Policy and Practice.

**Research in HRM:** Methodology to be adopted; Analysis of data; Report writing

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Management	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Financial Management	<b>Subject Code</b>	PHD102MG02

### Course Content

**Introduction to Financial Management:** Meaning, Scope, Objectives of Financial Management, Profit Maximization V/S Wealth Maximization, Role of Chief Financial officer

**Financing Decisions:** Different Sources of Finance, Cost of Capital, Capital Structure Decisions with various Theories, Leverages - Operating and Financial leverages

**Investment Decisions:** Time Value of Money, Various Methods of Capital Expenditure Decisions

**Dividend Decisions:** Issues in Dividend Decision, Walter's Model, Gardens Model, Modigliani and Miller Hypothesis, Forms of Dividend, Stability in Dividend Policy.

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Management	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Management Accounting	<b>Subject Code</b>	PHD102MG03

### Course Content

**Introduction to Management Accounting:** Meaning, Objectives, Scope, Role of Management Accountant, Financial Statement- Concepts, uses and limitations, Tools and Techniques of Financial Statements, Comparative Statement, Common Size Statement, Trend Analysis.

**Tools and Techniques of Management Accounting-I:** Ratio Analysis, Funds Flow Analysis, Cash Flow Analysis

**Tools and Techniques of Management Accounting-II:** (a) Budget and Budgetary Control- Meaning and Concept, Budget Manual, Key Factors, Type of Budget - Master, Production, Sales, Cash, Flexible, Capital; (b) Standard Costing- Meaning of Standard cost and Standard Costing, Setting of Standard Costs, Variance Analysis - Material, Labour, Overheads Variances; Responsibility Accounting.

**Decision Making:** (a) Cost-Volume-Profit (CVP) Analysis, (b) Various Managerial Decisions- Break Even Analysis, Profit Volume Ratio, Margin of Safety, Make or Buy Decisions, Shut Down Decisions, Product mix Decisions, Acceptance of export order and key factor Decisions, Divisional Performance and Transfer Pricing



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Management	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Marketing Management	<b>Subject Code</b>	PHD102MG04

### Course Content

**Basics of Marketing:** Definition of Marketing, and Marketing Management; Nature and scope of marketing; Marketing Environment: Macro and Micro Marketing Environment, Scanning the environment; Marketing organization; Marketing planning: marketing planning process; Sales planning and control, sales forecasting and policy making.

**Buying behaviour:** Need for studying consumer behaviour, consumer modelling: the economic model, learning model, psychoanalytic model, the sociological model, the Howard Sheth model of buying behaviour, the Nicosia model, the Engel - Kollat - Blackwell model; Consumer behaviour and perception, learning, personality, attitude, motivation; Social influence on consumer buying behaviour - groups, types of groups relevant to consumer behaviour; Industrial buying behaviour.

**Marketing Segmentation and Marketing Strategies-** segmentation basis, selection of segments, segmentation strategies, targeting and positioning; Marketing mix for product and services; 5 M's of Advertising, 6 C's of Distribution Channel; Marketing information system; Marketing strategy: product life cycle strategies, new product development and strategies.

Marketing research: application of marketing research, research process, research design, research tools, research analysis - factor analysis, cluster analysis, conjoint analysis, product research, packaging research, pricing research, promotion research, customer satisfaction research, sales and distribution research, brand research, advertising research.

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Management	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Principle and Practices of Management	<b>Subject Code</b>	PHD102MG05

### Course Content

Evolution of management Thoughts: Bureaucracy theory –Weber, Scientific management. F.W. Taylor, Administrative (Process) Management – Henry Fayola. Human relations era –Elton Mayo, Systems and contingency approach for understanding organizations Managerial Processes, functions. Skill and roles in an organization

Social Responsibility of Business: Understanding and managing individual behavior –Personality, Perception, Values, Attitudes, Learning, Work Motivation Theories, Individual decision making and problem solving.

Transactional Analysis, Johari window. Understanding and managing group. Processes; Interpersonal and group dynamics applications of emotional intelligence in organizations.

Group decision making, Leadership Theories, Delegation, MBO and Modern Management Thoughts.

Understanding and Managing organizational system –Organizational design and structure. Work stress Causes, Sources and Management of Stress.

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Mathematics	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Mathematics	<b>Subject Code</b>	PHD102MT01

**Course Content**

**Basic Concepts of Real and Complex Analysis:** Limits, Continuity, Uniform Continuity, Differentiability, Riemann Integral, Metric space, Sequence and series, Algebra of complex numbers, Analytic functions, Power series, Taylor's and Laurent's series, Conformal mapping.

**Basic Concepts of Linear Algebra:** Vector space, Subspace, Linear dependence, Basis, Linear transformation, Algebra of matrices, Rank of matrix, Determinants, Linear equations, eigen values and eigen vectors, Quadratic forms.

**Discrete Mathematics:** Partially ordered sets, Lattices, Complete Lattices, Distributive lattices, Complements, Boolean algebra, Elements of Graph Theory, Eulerian and Hamiltonian graphs, Planar Graphs, Directed graphs, Trees, Spanning trees, Fuzzy set theory

**Differential Equations:** First order ODE, singular solutions, initial value problem of first order ODE, general theory of homogeneous and non-homogeneous linear ODE, variation of parameters.

**Basic concepts of probability:** Sample space, discrete probability, simple theorems on probability, independence of events, Bayes Theorem. Discrete and continuous random variables, Binomial, Poisson, Uniform, Exponential, Weibull and Normal distributions ; Expectation and moments, independence of random variables.

**Linear/Non-Linear Programming Basic Concepts:** Convex sets. Linear Programming Problem ( LPP ). Examples of LPP, Hyperplane, open and closed half – spaces. Feasible, basic feasible and optimal solutions, Extreme point and graphical method, K-T conditions.

**Operational Research Modeling:** Definition and scope of Operational Research, Different types of models, Replacement models and sequencing theory, inventory problems and their analytical structure. Simple deterministic and stochastic models of inventory control, Basic characteristics of queueing system, different performance measures. Steady state solution of Markovian queueing models : M/M/1, WW1 with limited waiting space MWC, M/M/C with limited waiting space.

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Engineering	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Mechanical Engineering	<b>Subject Code</b>	PHD102ME01

**Course Content**

**Thermal Engineering**

Heat Transfer Modes of heat transfer one dimensional heat conduction resistance concept electrical analogy unsteady heat conduction fins dimensionless parameters in free and forced convective heat transfer various correlations for heat transfer in flow over flat plates and through pipes thermal boundary layer effect of turbulence radioactive heat transfer, black and grey surfaces shape factors heat exchanger performance, LMTD and NTU methods.

**Fluid Mechanism and Application**

Fluid Mechanics : Fluid properties fluid statics manometers buoyance control-volume analysis of mass momentum and energy fluid acceleration differential equations of continuity and momentum Bernoulli's equation viscous flow of incompressible fluids boundary layer flow through pipes head losses in pipes bends etc.

Application: power engineering steam Tables Rankin Brayton cycles with regeneration and reheat I c engines air standard Otto diesel cycles refrigeration and air conditioning vapour refrigeration cycle heat pumps gas refrigeration reverse Brayton cycle moist air psychometric chart basic psychometric processes. turbo machinery, Pelton- wheel, Francis and Kaplan turbines impulse and reaction principles velocity diagrams.

**Design Mechanics and Vibration**

Design: Design for static and dynamic loading failure theories fatigue strength and the S-N Diagram principles of the design of machine elements such as bolted riveted and welded joints shafts spur gears rolling and sliding contact bearings brakes and clutches.

Engineering Mechanics: Free body diagram and equilibrium trusses and frames virtual work kinematics and dynamics of particles and of rigid bodies in plane motion including impulse and momentum (linear and angular) and energy formulations impact

Strength of Materials: stress and strain stress strain relationship and elastic constants Mohr's circle for plane stress and plane strain thin cylinders shear force and bending moment diagrams bending and shear stresses deflection of beams torsion of circular shafts.

Theory of Machine: Displacement, velocity and acceleration, analysis of plane mechanism dynamic analysis of slider crank mechanism gear train fly wheel

Vibration: Free and force vibration of degree of freedom system effect of damping vibration isolation resonance critical speeds of shafts

### **Engineering Materials and Production Engineering**

Engineering Materials: Structure and properties of engineering materials heat treatment stress strain diagram for engineering materials

Metal Casting Design of patterns moulds and cores solidification and cooling riser and gating design considerations

Forming Plastic deformation and yield criteria fundamentals of hot and cold working process sheet metal forming processes shearing deep drawing bending principle of powder metallurgy

Metal join in process using welding brazing and soldering adhesive bonding design consideration in welding

Machining and machine tool operation .Mechanics of machine single and multipoint cutting tools tool geometry and materials tool life and where economics off machining principles of non-traditional machining process principles of work holding principle of design of jigs and fixtures

Machine tools Conventional type and CNC machine

### **Industrial Engineering**

Metrology and inspection .limits FITS and tolerance liner and angular measurement comparators gauge design interferometry from and finish measurement alignment and testing methods tolerance analysis in manufacturing and assembly

Operation Research: Linear programming simplex and duplex method transportation assignment network flow models simple queuing models PERT and EPM

Production planning and control: Forecasting model aggregate production planning scheduling material requirements planning

Inventory control

Time and Motion studies: Material handling and supply chain management.

## Ph. D. Course Work Syllabus

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Microbiology	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Microbiology	<b>Subject Code</b>	PHD102MB01

### Course Content

**Biosafety Lab (BSL) conditions:** Rules for maintaining the Biosafety in the Microbiology

laboratory, Making the aseptic, sterilized and dust free conditions in the lab for prevention of unwanted contamination of the sterilized lab from outer sources.

**Culture, Characterization and Identification:** Awareness about of types of Culture media for both aerobic and anaerobic microbes under extreme conditions. Knowledge of Biochemical, Serological and Molecular biological aspects of techniques are essential

**Laboratory Animal Care:** Maintenance of Germ free animals (rat, mice, guinea pigs) and, inoculation via various route, immunization schedule and their knowledge , handling of WISTAR rats, Swiss albino, Balb/C mice and Rabbits is required, Also knowledge of Cell and Animal tissue culture.

**Research in Biology:-** Microbiological, Serological and Molecular biology related problems and assumptions, Search of Antimicrobial herbal products, Immunomodulation, Secondary metabolical product of Microbes study problems, Reference and literature search, Records and presentation of data, Biological literature, Technical papers, Abstracts, Reprints and other literature

**Principles And Application:** PCR and RT-PCR, Gel documentation, RAPD and RFLP,PAGE and Western and Southern blotting., Special staining, and Microscopy

**Principles And Applications:** Spectrophotometer, Ultra violet and infra-red Spectrophotometer, ELISA, Geldoc, PAGE, Thermocycler, Microscope,

**Principles And Applications of Electrophoresis:** Paper electrophoresis and Gel electrophoresis.

**Centrifugation techniques:** Principle, Types of centrifuges and their applications

**General Principles and techniques of Histology:** Microtomy and Histopathology, Cryotomy and Microphotography.

**Quantitative Estimations:** Principle, methods and applications of Protein, Lipids, Enzymes, Free Radicals, Antigen and Antibody estimation

**Biostatistics:** Mean, Median, Mode, Histograms, Frequency curve, Frequency polygons, Bar diagrams, Pie-diagrams, Standard Deviation and Standard Error, Normal Distribution and Binomial Distribution

**Test of Significance Based on large Samples and Small Samples:** t-Test, Chi square test, ANOVA, Basics of correlation and Regression analysis

**Computer applications:** Basic idea of computers: MS Word, power point and excel

**Bioinformatics:** Definition, role, scope and limitations

**Biological data and databases:** Biological data type, classification of biological data base, Sequence databases: Gen Bank, SWISS-PROT,

Secondary nucleotide and protein sequence databases: CUTG, PROSITE

Specialized databases: KEGG, ENZYME

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Teaching Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacology	<b>Subject Code</b>	PHD102PS01

### Course Content

A detailed study of the mechanism of action, pharmacology and toxicology of drugs used in

**Autonomic Nervous System** - Parasympathomimetics and lytics, sympathomimetics and lytics, agents acting at neuromuscular junction and ganglia.

**Local and general anesthetics.**

**Central Nervous System** – General anesthetics, sedatives, hypnotics. Drugs used to treat anxiety, depression, psychosis, mania, epilepsy, neurodegenerative diseases, drug dependence and addiction.

**Cardiovascular System** - Diuretics, anti ischemics antihypertensives, antiarrhythmics, drugs for heart failure and dyslipidemia.

**Autocoid Pharmacology** - A study of the mechanisms involved in the formation, release, pharmacological actions and possible physiological role of histamine, serotonin, kinins, prostaglandins, opioidautocoids and cyclic 3' –5' AMP. Systemic pharmacology of drugs acting as agonists and antagonist to the autocoids.

**Immunopharmacology** - Cell and biochemical mediators involved in allergy,

**Immunomodulation and Inflammationm** - Classification of hypersensitivity reactions and diseases involved. Therapeutic agents for allergy, asthma, COPD and other immunological diseases with emphasis on immunomodulators.

**GIT Pharmacology** - Antiulcer, prokinetics, antiemetics, antidiarrhoeal and drugs for constipation and irritable bowel syndrome.

Analgesics and anti-inflammatory agents. Hormone and hormone antagonists.

Antibiotics & chemotherapeutic agents.



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacology and Toxicology	<b>Subject Code</b>	PHD102PS02

### Course Content

Principles of toxicology

Abnormal action of drugs such as tolerance, addiction, habituation, idiosyncrasy, allergy, hypersensitivity, antagonism, synergism, potentiation, tachyphylaxis.

Heavy metals poisoning.

Drug interactions & rationale for drug combinations, its implications and possible means to avoid them.

Drug – Drug interactions involving antibiotics, cardiovascular drugs, antihistaminic drugs and analgesic, anti-inflammatory agents.

Various mechanisms of drug interaction, drug-food interaction and drug - drug interaction. Single dose and repeat dose toxicity studies; factors influencing such studies such as species, sex, size, route, dose level, data evaluation and regulatory requirements.

Reproductive toxicology assessment of male reproductive toxicity, spermatogenesis; risk assessment in male reproductive toxicity; female reproductive toxicology; oocyte toxicity; alterations in reproductive endocrinology; relationship between maternal and developmental toxicity.

Mutagenicity - Mechanisms of mutagenesis, point mutations; individual chromosomes and complete genome mutations, germ cell mutations, somatic cell mutation; tests systems in vitro, test for gene mutation in bacteria, chromosome damage, gene mutation, in vivo micronucleus tests in rodent, metaphase analysis.

Carcinogenicity - Principles of carcinogenicity, prechronic studies for dose testing, chronic study, transplacental carcinogenesis; Cocarcinogenesis/tumor promotion, estimation of carcinogenicity of complex mixtures.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Administration	<b>Subject Code</b>	PHD102PS03

### Course Content

**Pharmaceutical Management** - Meaning, evolution-scientific, administrative and human relation approach. process of management - planning, organizing, staffing, directing, coordinating and controlling—a preliminary idea of concepts, processes and techniques. Fundamental concepts of production, financial, personal, legal and marketing functions with special reference to pharmaceutical management. Introduction to budgeting, costing, accounting, auditing and budgetary control. Entrepreneurship development.

**Understanding organizations** - Meaning, process, types of organization structures and departmentation, line/staff authority, promoting organizational culture. Organizations, pharmaceutical services and functioning of hospital pharmacy, bulk drug unit, formulation unit, ayurvedic and unani manufacturing units and testing labs etc.

**Decision Making** - Types, procedures, evaluation and selection of alternatives, decision making under various situations. Management information and decision support systems and time management.

**Personnel Management** - Job Analysis, recruitment, selection, orientation and training, performance appraisal and compensation. Retrenchment, lay off and discharge.

**Management of Industrial Relations** - Industrial disputes, settlement of disputes through various routes such as bargaining, etc.

Motivational aspects, theories of motivation, group dynamics, rewards and incentives, interpersonal skills, significance of communication, its processes, measures for effective communication, conflict management. Stress management.

**Production planning and control, production processes** - mass, job and project; plant location and lay out; materials management- purchase, inventory control and store keeping. Productivity management: Concepts, problems, tools and techniques for improvement. Operation research techniques by PERT and CPM.

**Pharmaceutical marketing channels** - Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical

distribution management.

**Pharmaceutical Marketing** - Evolution of marketing concept; production oriented, sales oriented, promotion oriented and consumer oriented; market segmentation; concept of marketing mix role of 7 P's (product, price, promotion, place, physical evidence, process, people) in Pharmaceutical Marketing Management, corporate planning & strategy, pharmaceutical industrial marketing management. Pharmaceutical marketing environment. Product management. E-Pharma marketing.

Marketing Research: Definition and importance, pharmaceutical marketing research techniques, marketing information system, pharmaceutical marketing research area.

**Market Demands and Sales Forecasting** - Major concepts in the demand measurement, estimating current demands, geo-demographic analysis, estimating industry sales, market share and future demand, sales forecasting.

**Product Decision** - Meaning, Classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; new product decisions; product branding, packaging and labeling decisions, product management in pharmaceutical industry. Pricing- Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

**Promotion**- meaning and methods, determinants of promotional mix, promotional budget; an overview - personal selling, advertising, sales promotion and public relations.

Strategic marketing planning; Marketing implementation and evaluation.

<b>Course</b>	Doctor of Philosophy	<b>Contact Hours</b>	75
<b>Branch</b>	Pharmaceutical Sciences	<b>Subject Code</b>	PHD102PS04
<b>Subject Name</b>	Elective- Pharmaceutical Analysis		

**Course Content**

Application of instrumental methods in the development of medicines, concept of analytical methods development.

An advanced study of the principles and procedures involved in non-aqueous, complexometric, oxidation-reduction and diazotization methods

An advanced study of the principles and procedures involved in the electrometric methods: conductometry, potentiometry, and polarography and amperometry

Validation and calibration of various instruments used for drug analysis such as UV-Visible spectrophotometer, IR spectrophotometer, spectrofluorimeter, HPLC, HPTLC and GC. Principle and procedures involved in following - Non-aqueous titration, complexometric titration, gravimetric methods, diazotisation titration, potentiometry, UV-Visible method, HPLC, GC and TLC, supercritical fluid chromatography (SFC).

Thermal Methods of Analysis - Theory, instrumentation and applications of thermo gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) and thermo mechanical analysis (TMA).

X-ray Diffraction Methods - Introduction, generation of X-ray, elementary crystallography, Miller indices, X-ray diffraction, Bragg's law of X-ray powder diffraction, X-ray powder diffractometer, obtaining and interpretation of Xray powder diffraction data.

Radiochemical Assays - Sodium iodide, cyanocobalamin and quality control of radiopharmaceuticals. Radioimmune assays of drugs and hormones.

Immunological Assays - ELISA, immunoblotting, immunofluorescence, immunoaffinity. Enzyme Analysis - Pepsin, papain, hyaluronidase.

Analysis of drugs obtained from genetic engineering - Vaccines, sera and toxoids.

Electron Spin Resonance - Principle, instrumentation, interpretation of spectra and applications.

Laser - Basic principles, classification, instrumentation and application of laser. Reference standards - Source, preparation, characterization, usage, storage and records.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Assurance	<b>Subject Code</b>	PHD102PS05

### Course Content

Quality Control And Assurance Technique - Basis concepts of quality, developing quality culture

Basic principles and concepts of quality management viz. quality control, quality assurance, quality auditing and ISO system etc.

Quality Assurance General Concepts - Definition of quality assurance concept and components of Q. A., good manufacturing practices and its applications to pharmaceutical industry.

Personnel, Premises and Equipments - Qualification, experience, training responsibilities and hygiene of personnel. drainage system, sewage, sanitation, lighting, maintenance of building and premises; design, size, location, construction, cleaning and maintenance of equipments. documents and formats related to personnel, premises and equipment.

Material Management - Purchasing, raw material, packaging materials, intermediate and bulks products, finished products, rejected and recovered materials, recalled products, returned goods, reagents and culture media, waste materials, reference standards, miscellaneous material. documents and formats.

Manufacturing Operations and Control - Revised schedule M, sanitation of manufacturing premises, mix-ups and cross contamination, processing of intermediates and bulk product, packaging operations, I.P.Q.C., release of finished products process deviations, drug product inspection, expiration dating, document and formats.

Technology transfer from R & D to manufacturing.

Product change over, basic requirements of cleaning and its validation.

Documents and Records - Specification, master production and control record, batch production and control record, significance of SOPs and record, change control, drug master file, documents and formats.

Pharmaceutical Validation - Definition & concept of validation, validation of building, equipment, instruments and facilities, process validation, cleaning-validation, validation master plan, documents

and formats.

Quality Control of Biological products - International biological standards, safety testing of pharmaceutical quality control of antibiotics.

Pharmaceutical Plant Audit - Department wise documents and audit questionnaire.

Sterile pharmaceutical products - GMP aspects related to sterile products, general guidelines, personnel, building and premises, equipment, sanitation, processing, sterilization, quality control and validation, documentation

Market complaint and handling of returned goods.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Biotechnology	<b>Subject Code</b>	PHD102PS06

### Course Content

**Biotechnology in Pharmaceutical Sciences Perspective** - Biology in drug discovery; traditional drug discovery vs. rational drug discovery. Rational drug discovery pipeline. Concept of target based drug design and target discovery. Role of plant biotechnology in edible vaccine development.

**Genomics in Target Discovery:** Concept of genome, genes and gene expression. Genome sequencing and sequence comparison methods (e.g. BLAST), gene expression comparison methods (microarray). Comparative genomics and expression genomics for target discovery of communicable disease and lifestyle disease.

**Systems and Methods of Molecular Biology** - Isolation and validation of targets, PCR, RT-PCR nucleic acid isolation, cloning vectors (some examples), enzymes used in molecular cloning methods (some examples). Cloning and characterization of biopharmaceuticals.

**Expression Purification and Assay:** Gene expression in E. coli, in baculovirus, in mammalian cells. Various protein purification methods. Enzymes based assay for small molecule screening.

**Bioprocess Technology** - Introduction to microbial growth, media formulation, fermentation processes, design, operation and characteristics of fermentation processes, instrumentation and bioprocess control.

**Downstream Process** - Introduction to various downstream process operations in biopharmaceutical manufacturing such as centrifugation, filtration, tangential flow filtration, cell disintegration, solvent-solvent extraction, supercritical fluid extraction etc.

**Biotechnology in Pharmaceutical Industry** - Major areas for biotechnology in the pharmaceutical industry such as antibiotics, vaccines, diagnostics, antibodies, biopharmaceuticals (insulin, interferon, GSF, CSF & therapeutic proteins etc.); commercial aspects, priorities for future biotechnological research.

**Industrial enzymes in drug development** - Penicillin amidase, lipase, oxidoreductase, nitrilase, protease etc. Use of all these enzymes for enantioselective synthesis of pharmaceutically important drugs/drug intermediates, future directions.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Chemistry	<b>Subject Code</b>	PHD102PS07

### Course Content

Aromaticity, electrophilic & nucleophilic substitution in aromatic systems, E1, E2 mechanisms, Hofmann and Saytzeff elimination, competition between elimination and substitution, intramolecular elimination, addition reactions, Markownikovs rule, nucleophilic additions, hydride transfer reactions, Cram's rule, participation of neighboring groups in transannular rearrangements.

Stereochemistry - Molecular dissymmetry, compounds with one or two or more unequal asymmetric carbon atoms, configurations, absolute, relative, racemic modifications, optically active compounds, cyclohexane, six membered heterocyclic rings stereoisomerism of allenes and related compounds.

Survey of recent advances in following areas, brief chemistry, and synthetic approach to marketed drugs, mode of action, SAR, of following class of drugs: Cardiovascular (antihypertensives, antiarrhythmics, antianginals, cardiotonics), CNS (anesthetics, sedative– hypnotics, anticonvulsants, antipsychotics and CNS stimulants), immunosuppressants, immunostimulants, antibacterials, antivirals, antineoplastics, drugs for tropical diseases and malaria, tuberculosis, leprosy, amoebiasis, and leishmania, radio protectives, diuretics, antihistaminics, cholinergic and anticholinergics.

Microorganism in Drug Synthesis - Introduction, theoretical and practical aspects of microbial transformation, microbial conversion of antibiotics.

Molecular concept of drug receptor interactions. Advances in following classes of receptors and their drug ligands, opioid, dopamine, adrenergic, cholinergic, histamine, 5-HT<sub>1A</sub>, GABA. Combinatorial Chemistry - solid phase synthesis, different types of polymer supports, linkers, Strategies of library synthesis and characterization solid phase strategies

An overall treatment of various approaches to drug design including the method of variation, e.g. Fibonacci search, Topliss tree, Craigs plot, simplex methods, and cluster analysis. Quantitative structure activity relationships (QSAR) with detail coverage of Hansch's Liner method, Free and Wilson methods, mixed approached principal component analysis and application



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Computer Aided Drug Design: Basic concept of computational chemistry like Quantum mechanics, molecular mechanics, force fields, energy minimization, conformational reaction, molecular dynamics. Ligand based drug design based on active site of receptor/enzyme.

Indirect Drug Design: Analog approach, pharmacophore mapping, template forcing, excluded volume & shape analysis, artificial intelligence methods.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Marketing Management	<b>Subject Code</b>	PHD102PS08

### Course Content

Pharmaceutical Marketing - Evolution of marketing concept; production oriented, sales oriented, promotion oriented and consumer oriented; market segmentation; concept of marketing mix Role of 7 P's (product, price, promotion, place, physical evidence, process, people) in pharmaceutical marketing

Product Decision - Meaning, classification, product line and product mix decisions, product life cycle, product portfolio analysis; product positioning; new product decisions; product branding, packaging and labeling decisions, product management in pharmaceutical industry. Pricing - Meaning, importance, objectives, determinants of price; pricing methods and strategies, issues in price management in pharmaceutical industry. An overview of DPCO (Drug Price Control Order) and NPPA (National Pharmaceutical Pricing Authority).

Pharmaceutical marketing channels: Designing channel, channel members, selecting the appropriate channel, conflict in channels, physical distribution management: Strategic importance, tasks in physical distribution management.

Promotion - meaning and methods, determinants of promotional mix, promotional budget; an overview - personal selling, advertising, sales promotion and public relations.

Strategic marketing planning; marketing implementation and evaluation.

Pharmaceutical Management - Meaning, evolution-scientific, administrative and human relation approach. Process of management, planning, organizing, staffing, directing, coordinating and controlling—a preliminary idea of concepts, processes and techniques.

Decision Making - Types, procedures, evaluation and selection of alternatives, decision making under various situations. Management information and decision support systems and time management.

Personnel Management - Job analysis, recruitment, selection, orientation and training, performance appraisal and compensation. Retrenchment, lay off and discharge.

Management of Industrial Relations - Industrial disputes, settlement of disputes through various routes such as bargaining, etc.

## Ph. D. Course Work Syllabus

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Motivational aspects, theories of motivation, group dynamics, rewards and incentives, interpersonal skills, significance of communication, its processes, measures for effective communication, conflict management. Stress management.

Management, corporate planning & strategy, pharmaceutical industrial marketing management. pharmaceutical marketing environment. Product management. E-Pharma marketing.

Marketing Research - Definition and importance, pharmaceutical marketing research techniques, marketing information system, pharmaceutical marketing research area.

Market Demands and Sales Forecasting - Major concepts in the demand measurement, estimating current demands, geo-demographic analysis, estimating industry sales, market share and future demand, sales forecasting.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Technology	<b>Subject Code</b>	PHD102PS09

### Course Content

Tablet Technology - Systematic and modern approach to tablet components and production designs. Process of compression and physics of tablet compression, effect of additives on tablet strength, crushing strength, tensile strength, friability. Press design and layout, press control, trouble shooting, recent tablet technologies. Tablet coating theory, techniques of coating, mechanism of coat formation, coating compositions, physico– mechanical properties of polymer films, coating of single unit and multi-particulate systems. Industrial coaters, process atomization and optimization, coating problems and troubleshooting. Compression of multiparticulates (MUPS)

Capsule Formulation Development - Consideration for design of large scale manufacturing unit including intricate design criteria for units to manufacture of Capsules.

Dissolution Technology and IVIVC - Historical development, compendial and noncompendial dissolution methodologies; US FDA guidance; techniques of dissolution enhancement; in vitro drug release kinetics, introduction to BCS & IVIVC; levels of correlation, prediction of IVIVC based on BCS; dissolution data analysis with view to IVIVC; BCS and IVIVC based biowaivers.

Fundamentals of Sustained, Controlled and Targeted Drug Delivery - Basics, design of sustained release dosage forms. Need and fundamentals and techniques of targeting.

Sterile Formulation - Requirement, components, materials, Pharmacopoeial requirements for SVP & LVP, special types of parenterals such as suspensions, emulsions, dried forms, sterile diagnostics and radiopharmaceuticals. Environmental control: Temperature and humidity control, air handling systems, GMP and regulatory guidelines

Sustained Release Parenterals - Liposomes, niosomes, nanoparticles, proteins and peptides, implants, loaded erythrocytes.

Ophthalmic products - Drug absorption in eye, formulation consideration and evaluation of ophthalmic products, contact lenses, occuserts, container and closures, safety.

## Ph. D. Course Work Syllabus

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Transdermal Drug Delivery Systems - Theory, design, formulation and evaluation including iontophoresis, sonophoresis and other latest developments in skin delivery systems. Development and evaluation of transdermal devices and osmotic pumps.

Design and development of packaging units including recent advances in packaging techniques for various types of sterile and non sterile dosage forms. Stability aspects of packaging.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutics	<b>Subject Code</b>	PHD102PS10

### Course Content

Optimization - Definition, need, advantages, meaning of general terms involved in optimization process. Classification of optimization methods.

Brief description and importance of experimental design with special reference to designs adequate for large number of variables. Introduction of correlation, regression analysis, mathematical model and contour plots.

Tablets - Formulation, special tablets, preparation of components for compression, evaluation of tablets, equipments and processing problems in tablet.

Liquids - Formulation considerations of oral liquids, suspensions, emulsions, development of various products. Formulation consideration of parenteral, ophthalmic, depot products.

Disperse Systems - Molecular dispersion, coarse dispersions- physical stability of suspensions and emulsion, role of zeta potential in stability of coarse dispersions, theory of emulsification, micro and multiple emulsions. Drug kinetics in coarse disperse systems.

Topical and rectal formulations and evaluation.

Controlled Drug Delivery Systems (CDDS) - Concepts and rationale, classification of controlled release systems, carriers for CDDS, design and evaluation. Release kinetics.

Microencapsulation - General considerations, various techniques employed for micro- encapsulation, evaluation and application.

General considerations and Applications of following Drug Delivery System - Bioadhesive and mucoadhesive drug delivery, nasopulmonary drug delivery, ocular drug delivery, pro- drug, transdermal, osmotic, colon specific drug delivery, implants and inserts.

Bioavailability and bioequivalence - Bioequivalence and its determination, study design for the assessment of bioavailability and bioequivalence, factors influencing bioavailability and bioequivalence. *In vitro - in vivo* correlation.

Molecular basis of targeted drug delivery.

## Ph. D. Course Work Syllabus

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General considerations, methods of preparation, characterization and applications of following drug delivery systems - Liposomes, niosomes, nanoparticles, solid lipid nanoparticles, resealed erythrocytes, dendrimers, multiple emulsions, submicron emulsion.

An overview and applications of following drug delivery systems - Aquasomes, pharmacosomes, transfersomes, liquid crystals, magnetically modulated drug delivery, peptide and protein drug delivery.

Polymers and their Applications in Development of NDDS: Introduction, basic properties of biodegradable and non-biodegradable polymers and their uses.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutics (Drug Regulatory Affairs)	<b>Subject Code</b>	PHD102PS11

### Course Content

Legislation to regulate the profession of pharmacy – The Pharmacy Act 1948.

Legislation to regulate, import, manufacture distribution and sales of drugs, cosmetics- The Drugs & Cosmetic Act 1940 & rules 1945 with amendments.

Regulatory aspects of pharmaceutical and bulk drug manufacture and biotechnology derived product.

Quality safety and legislation for cosmetic and herbal products.

Aims, objects and salient features of following legislations governing Pharmaceutical Industry:  
Pollution Control Act

Prevention of Food Adulteration Act 1954 Industrial Development & Regulation Act 1951 Consumer Protection Act

Standard institutes & certification agencies like ISI, BSS, ASTM, SO, WHO, US-FDA, UK- MCA, TGA.

Drug Master File (Case Study-3 examples). Material Safety Data Sheet (MSDS) preparation. Industrial Safety & Health.

Guide lines for filing in countries like US & EU.

Drug Regulatory Agencies-Historical perspectives, organization structure activities & responsibilities: India, US, EU, Japan, ICH.

Study of compendia – Evolution, Study of parts of compendia like: Policies, general notices, monographs, comparative picture of IP, USP, BP, EP&GP.



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacognosy	<b>Subject Code</b>	PHD102PS12

### Course Content

Introduction to Herbs and Ayurveda - Concept of tridosha, role of pancha karma in ayurveda, origin of charka samhita, comparison of ayurveda with other systems of healing likes unani, siddha, homeopathy and yoga.

Nutraceuticals - General introduction, classification of nutraceuticals, inorganic mineral supplements, vitamin supplements, dietary fibers, antioxidants, health drinks, natural sweeteners, cereals and grains, polyunsaturated fatty acids.

Herbal medicines for diseases like asthma, alzheimer's disease, dengue fever, diarrhoea, epilepsy, goiter, gout, hypertension, jaundice, leukemia, obesity, and ulcer of stomach, eczema and diabetes.

Herbs used with respiratory tract problems, Diabetes, antioxidants and human health benefits. Profiles for commercial cultivation technology and post harvest care of following medicinal plants- ashwagandha, periwinkle, medicinal yams, ergot, guggal, belladonna, senna, rauwolfia, opium poppy, psyllium, steroid bearing solariums ammimajus, ipecac, datura, aloe, henbane, digitalis, saffron.

General Methods of Extraction, Isolation and Characterization of Bioactive Constituents Different extraction methods including advanced extraction techniques like supercritical fluid extraction, microwave-assisted extraction, ultrasound assisted extraction, solid-phase microextraction including headspace technique. Isolation techniques, fractionation and solvent partitioning.

Significance of Important Techniques in Establishing Identity, Purity and Quality of Plant Drugs (as described in different Pharmacopoeias, documents of WHO and EMEA): Macroscopic, Organoleptic methods including gross morphology, sampling, preliminary examination and foreign matter, Physico-chemical, Solubility, specific gravity, optical rotation, specific rotation, refractive index, melting point, swelling index, foaming index and bitterness value. Moisture content. Ash values, extractive values including volatile oil, qualitative chemical tests, quantitative chemical tests: acid value, iodine value, saponification value, ester value, unsaponifiable matter and acetyl value, microscopic, general microscopy, histochemistry. Quantitative Microscopy - Lycopodium spore method, palisade ratio,

stomatal number, stomatal index, veinlet number and veinlet termination number, microbiological (including microbial limits), biological evaluation.

Plant Tissue Culture: Historical perspectives, types and techniques. Organogenesis and embryogenesis, micro propagation of medicinal and aromatic plants. Nutritional requirement of tissue culture, culture media, growth and metabolism of plant tissue culture. Growth parameters of callus and cell culture. Secondary metabolism in tissue cultures, production of pharmaceuticals. Role of plants growth of regulators in tissue culture.

Genetic engineering with special reference to plant cells and micro-organisms Mutation, Hybridization and dyploides chemodems and artificial prod. of mutations.

Purification techniques for isolated phytoconstituents.

Introduction to different techniques of characterization of bioactive constituents.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacognosy and Phytochemistry	<b>Subject Code</b>	PHD102PS13

### Course Content

Introduction to herbs and ayurveda: Concept of tridosha, role of pancha karma in ayurveda, origin of Charka samhita, comparison of ayurveda with other systems of healing likes unani, siddha, homeopathy and yoga.

General Methods of Extraction, Isolation and Characterization of Bioactive Constituents - Introduction, definition, factors influencing the choice of extraction, principles of extraction methods, types of extraction and different extraction methods. including advanced extraction techniques like supercritical fluid extraction, microwave-assisted extraction, ultrasound assisted extraction, solid-phase microextraction including headspace technique and their merits and demerits. Selection and purification of solvents for extraction. Fractionation and solvent partitioning.

Purification techniques for isolated phytoconstituents.

Significance of Important Techniques in Establishing Identity, Purity and Quality of Plant Drugs (as described in different Pharmacopoeias, documents of WHO and EMEA) - Macroscopic, organoleptic methods including gross morphology, sampling, preliminary examination and foreign matter, physico-chemical, solubility, specific gravity, optical rotation, specific rotation, refractive index, melting point, swelling index, foaming index and bitterness value, moisture content, ash values, extractive values including volatile oil, qualitative chemical tests, quantitative chemical tests: acid value, iodine value, saponification value, ester value, unsaponifiable matter and acetyl value, microscopic, general microscopy, histochemistry. quantitative microscopy: lycopodium spore method, palisade ratio, stomatal number, stomatal index, veinislet number and veinlet termination number, microbiological (including microbial limits), biological evaluation.

Plant Tissue Culture - Historical perspectives, types and techniques, organogenesis and embryogenesis, micro propagation of medicinal and aromatic plants, nutritional requirement of tissue culture, culture media, growth and metabolism of plant tissue culture, growth parameters of callus and cell culture, secondary metabolism in tissue cultures, production of pharmaceuticals role of plants growth of regulators in tissue culture.

Introduction to different techniques of characterization of bioactive constituents.

Natural Products as Markers for New Drug Discovery: The role of natural products chemistry in drug discovery, selection and optimization of lead compounds for further development with suitable examples.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacognosy Herbal Drugs	<b>Subject Code</b>	PHD102PS14

### Course Content

Herbal Based Drug Industries - Types, scope, study of infrastructure, staff requirement, project profiles, plant and equipment, processing, research and development, regulatory requirement, pilot scale up techniques, industrial methods and preparation of standardized extracts, principle, methods, merits and demerits, preparations of standardized extracts of garcinea, forskolin, garlic, turmeric and capsicum.

Standardization of Herbal Drugs - Importance of standardization and problems involved in the standardization of herbs. WHO Guidelines for quality standardized herbal formulations. Herbal drug formulation development: Selection of herbal ingredients. Different dosage forms of herbal drugs. Evaluation of different dosage forms. Standardization of Ayurvedic medicines. Standardization of Homeopathic medicines. Problems in standardization of Homeopathic medicines. Stability studies of herbal formulations.

Herbal Drug Foods - Introduction, classification, different categories of functional ingredients. Nutraceuticals, dietary fibres, oligosaccharides, polyunsaturated fatty acids (PUFA), peptides and proteins, vitamins, antioxidants, prebiotics and probiotics, enzymes carotenoids, fruits and vegetables with health benefits.

Herbal Cosmetics - Introduction, definition, classification, raw materials of herbal origin, incorporating the herbal extracts in various cosmetic formulations like skin care preparations, herbal cosmetics for hairs, nails, teeth and mouth.

Bioassays - Basic principles of bioassays, official bioassays, experimental models and statistical designs employed, biological standardization of oxytocin, insulin. Screening methods for biological activities: introduction, study of information retrieval methods of natural plants and herbal data bases. General methods of screening and review of natural products for the following biological activities: Anti bacterial activity, anti fungal activity, anti-viral activity, anti oxidant activity, anthelmintic activity, anti-neoplastic activity, anti- fertility activity, hepato protective activity, analgesics activity, anti inflammatory activity, anti ulcer activity, diuretic activity, hypo glycemic activity, anti psychotics activity, anti depressant activity, anti-hypertensive activity, hypolipidemic activity.

Alternatives to animal screening procedures, cell – line, patch clamp technique, in-vitro models,

molecular biology techniques.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacy Practice	<b>Subject Code</b>	PHD102PS15

### Course Content

Pharmacoepidemiology - Definitions and scope, methods, system for monitoring drug effects, advantages and disadvantages of pharmacoepidemiology.

Pharmacoeconomics - Definitions and scope, types of economic evaluation, cost models and cost effectiveness analysis.

Concept of Rational Use of Drugs - Importance of rational drug use, pharmacists role, drug use indicators, guidelines for rational prescribing.

Education and Training - Training of technical staff, training and continuing education for pharmacists, pharmacy students, medical staff and students, nursing staff and students, formal and informal meetings and lecturers. Ethical issues in biomedical research, good clinical practice, ethical committee, its constitution and functions, ethics of publication.

Medication Error and Medication Adherence: Categories and causes of medication error, tools to measure the performance of the medication use process, categories of medication non-adherence, role of pharmacist in medication error and medication adherence.

The role of hospital pharmacy department and its relationship to other hospital departments and staff.

Hospital Pharmacy Management - Staff, materials, financial, policy and planning, infrastructure requirements, workload statistics.

Hospital Pharmacy Services - Purchasing, storage, stability and safety of drugs, drug distribution, radiopharmaceuticals, additive services and total parenteral nutrition.

Introduction to the Concept of Community Pharmacy - its activities and professional responsibilities.

The role of the community pharmacy and its relationship to other local health care providers. Prescribed medication order - interpretation and legal requirements.

Patient counselling in community pharmacy. Over the counter (OTC) sales.

Health Education and Community Pharmacy - Family planning, first aid, communicable disease prevention, smoking cessation, screening programs.

Services to nursing homes/clinics.

Community Pharmacy Management - Financial, material and staff management, infrastructure requirements, drug information resources, computers in community pharmacy. Code of ethics for community pharmacists.

Polypharmacy and its implications.



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Management and Regulatory Affairs	<b>Subject Code</b>	PHD102PS16

### Course Content

Pharmaceutical Management - Meaning, evolution-scientific, administrative and human relation approach.

Production Management: Fundamentals of production, organization, economic policy, manufacturing economics, production capacities, production lines and job balancing, visible and invisible inputs, methodology of activities. Development of efficient work methods, quality control and management of R&D.

Productivity Management - Concepts, problems, tools and techniques for improvement. Operation research techniques by PERT and CPM

Pharmaceutical Marketing - Evolution of marketing concept; production oriented, sales oriented, promotion oriented and consumer oriented (modern concept); market segmentation; concept of marketing mix role of 7 P's (product, price, promotion, place, physical evidence, process, people) in pharmaceutical marketing management, corporate planning & strategy, pharmaceutical industrial marketing management, pharmaceutical marketing environment. product management. E-pharma marketing.

Product Planning - Selection of product, new product development and product differentiation, pricing, promotion - personal selling; salesmanship, qualities of salesman, management of sales force, advertising, publicity and window display, channels of distribution.

Marketing Research - Definition and importance, pharmaceutical marketing research techniques, marketing information system, pharmaceutical marketing research area

Market Demands and Sales Forecasting - Major concepts in the demand measurement, estimating current demands, geo-demographic analysis, estimating industry sales, market share and future demand, sales forecasting.

Origin, development, scope, objectives and nature of Pharmaceutical legislation in India. History and ethics of profession of Pharmacy. A study of regulatory aspects that affect drug product design, manufacture and distribution in India with special emphasis on the detailed study of the following Acts

(with latest amendments)

The Narcotics Drugs and Psychotropic Substances Act, 2001

Medicinal and Toilet Preparations (Excise Duties) Act, 1955. The Pharmacy Act, 1948.

The Drugs and Cosmetics Act, 1940 and Rules there under. Drugs (Price Control) Order in force.

Introduction to Intellectual Property Rights; Copy Right Act, Trade Mark Act, Patent Act and Biodiversity Act, WTO, TRIPS and TRIMS.

The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955. Prevention of Cruelty to Animals Act

Legal Environment of Business- Need for government regulations; financial regulations, SEBI, BIFR, FEMA and others, Contract Act and Sale of Goods Act, Company Act, Corporate tax laws - Direct and Indirect. Indian Patent Law: Critical evaluation of development of Indian Patent law with necessary changes. Comparison with US and EP Patent Law.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Analysis and Quality Control	<b>Subject Code</b>	PHD102PS17

### Course Content

Application of instrumental methods in the development of medicines, concept of analytical methods development.

An advanced study of the principles and procedures involved in non-aqueous, complexometric, oxidation-reduction and diazotization methods

An advanced study of the principles and procedures involved in the electrometric methods - Conductometry, potentiometry, and polarography and amperometry

Validation and calibration of various instruments used for drug analysis such as UV-Visible spectrophotometer, IR spectrophotometer, spectrofluorimeter, HPLC, HPTLC and GC. Principle and procedures involved in following - Non-aqueous Titration, complexometric titration, gravimetric methods, diazotisation titration, potentiometry, UV-Visible method, HPLC, GC and TLC, supercritical fluid chromatography (SFC).

Thermal Methods of Analysis - Theory, instrumentation and applications of thermo gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) and thermo mechanical analysis (TMA).

X-ray Diffraction (XRD) Methods - Introduction, generation of X-ray, elementary crystallography, Miller indices, diffractometers, obtaining and interpretation of XRD data.

Radiochemical Assays: Quality control of radiopharmaceuticals. Radioimmune assays of drugs and hormones.

Immunological Assays - ELISA, immunoblotting, immunofluorescence, immunoaffinity. Enzyme Analysis - Pepsin, papain, hyaluronidase.

Electron Spin Resonance: Principle, instrumentation, interpretation of spectra and applications.

Reference Standards - Source, preparation, characterization, usage, storage and records. Quality Control and Assurance Technique - Basis concepts of quality, developing quality culture.

Manufacturing Operations and Control - Revised schedule M, sanitation of manufacturing premises, mix

–ups and cross contamination, processing of intermediates and bulk product, packaging operations, I.P.Q.C., release of finished products process deviations, drug product inspection, expiration dating, document and formats.

Documents and Records - Specification, master production and control record, batch production and control record, significance of SOPs and record, change control, drug master file, documents and formats.

Quality Control of Solid Dosage Forms - Tablets and capsules. Liquid dosage forms: oral and topical, parenterals, aerosols,

Quality Control of Biological Products - International biological standards, safety testing of pharmaceutical quality control of antibiotics.

Selection and evaluation of packaging material, containers and closures. Pharmacopoeial specifications, tests and standards for packaging material.

Sterility testing of pharmaceutical products. Determination of shelf life by accelerated stability testing

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Analysis and Quality Assurance	<b>Subject Code</b>	PHD102PS18

### Course Content

Application of instrumental methods in the development of medicines, concept of analytical methods development.

An advanced study of the principles and procedures involved in non-aqueous, complexometric, oxidation-reduction and diazotization methods

An advanced study of the principles and procedures involved in the electrometric methods - Conductometry, potentiometry, and polarography and amperometry

Validation and calibration of various instruments used for drug analysis such as UV-Visible spectrophotometer, IR spectrophotometer, spectrofluorimeter, HPLC, HPTLC and GC. Principle and Procedures Involved in Following - Non-aqueous titration, complexometric titration, gravimetric methods, diazotisation titration, potentiometry, UV-Visible method, HPLC, GC and TLC. supercritical fluid chromatography (SFC).

Thermal Methods of Analysis - Theory, instrumentation and applications of thermo gravimetric analysis (TGA), differential thermal analysis (DTA), differential scanning calorimetry (DSC) and thermo mechanical analysis (TMA).

X-ray Diffraction (XRD) Methods - Introduction, elementary crystallography, diffractometers, obtaining and interpretation of XRD data.

Radiochemical Assays - Quality control of radiopharmaceuticals.

Immunological Assays - ELISA, immunoblotting, immunofluorescence, immunoaffinity. Enzyme Analysis - Pepsin, papain, hyaluronidase.

Analysis of Drugs obtained from Genetic Engineering: Vaccines, sera and toxoids.

Electron Spin Resonance - Principle, instrumentation, interpretation of spectra and applications.

Quality Control and Assurance Technique - Basis concepts of quality, developing quality culture

Quality Assurance General Concepts - Definition of quality assurance concept and components of Q.

A., good manufacturing practices, quality control – the concept

Personnel, Premises and Equipments - Qualification, experience, training responsibilities and hygiene of personnel, drainage system, sewage, sanitation, lighting, maintenance of building and premises, design, size, location, construction, cleaning and maintenance of equipments. documents and formats related to personnel, premises and equipment.

Material Management - Purchasing, Raw material, packaging materials, intermediate and bulks products, finished products, rejected and recovered materials, recalled products, returned goods, reagents and culture media, waste materials, reference standards, miscellaneous material. documents and formats.

Manufacturing Operations and Control - Revised schedule M, sanitation of manufacturing premises, mix –ups and cross contamination, processing of intermediates and bulk product, packaging operations, I.P.Q.C., release of finished products process deviations, drug product inspection, expiration dating, document and formats.

Documents and Records - Specification, master production and control record, batch production and control record, significance of SOPs and record, change control, drug master file, documents and formats.

Pharmaceutical Validation - Definition & concept of validation, validation of building, equipments, instruments and facilities, process validation, cleaning –validation, validation master plan, documents and formats.

Pharmaceutical Plant Audit - Department wise documents and audit questionnaire.

Sterile Pharmaceutical Products - GMP aspects related to sterile products- General guidelines, personnel, building and premises, equipment, sanitation, processing, sterilization, quality control and validation, Documentation.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacy Practice and Clinical Pharmacy	<b>Subject Code</b>	PHD102PS19

### Course Content

Pharmacoepidemiology - Definitions and scope, methods, system for monitoring drug effects, advantages and disadvantages of pharmacoepidemiology.

Pharmacoeconomics - Definitions and scope, types of economic evaluation, cost models and cost effectiveness analysis.

Concept of Rational use of Drugs - Importance of rational drug use, pharmacists role, drug use indicators, guidelines for rational prescribing.

Education and Training - Training of technical staff, training and continuing education for pharmacists, pharmacy students, medical staff and students, nursing staff and students, formal and informal meetings and lecturers, drug and therapeutics newsletter. Ethical issues in biomedical research – Principles of ethics in biomedical research, good clinical practice, ethical committee, its constitution and functions, ethics of publication.

Medication Error and Medication Adherence - Categories and causes of medication error, tools to measure the performance of the medication use process, categories of medication non-adherence, role of pharmacist in medication error and medication adherence.

The role of hospital pharmacy department and its relationship to other hospital departments and staff.

Hospital Pharmacy Management - Staff, materials, financial, policy and planning, infrastructure requirements, workload statistics.

Hospital Pharmacy Services - Purchasing, storage, stability and safety of drugs, drug distribution, radiopharmaceuticals, additive services and total parenteral nutrition.

Introduction to Clinical Pharmacy - Definition, development and scope.

Patient Data Analysis - The patient's case history, its structure and use in evaluation of drug therapy, presentation of cases. Communication skills including patient medication history interview, patient counselling, teaching skills. Understanding common medical abbreviations and terminologies used in clinical practices. Sensitivity screening for common pathogenic micro-organisms, its significance,

resistance in disease states and selection of appropriate anti-microbial regimens.

Research Design and Conduct of Clinical Trials - Research support including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of clinical trials. Monitoring and auditing of clinical trials. Design and execution of trials in different clinical settings.

Clinical Pharmacokinetics - Clinical pharmacokinetic models. Physiological determinants of drug clearance and volumes of distribution. Renal and non-renal clearance. Organ extraction and models of hepatic clearance. Estimation and determinants of bioavailability. Multiple dosing. Calculation of loading and maintenance doses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients. Therapeutic drug monitoring.



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Phyto Chemistry	<b>Subject Code</b>	PHD102PS20

### Course Content

Extraction - Introduction, definition, factors influencing the choice of extraction, principles of extraction methods, types of extraction and their merits and demerits. Selection and purification of solvents for extraction.

Methods of Isolation (Including Industrial Methods) Purification and Characterization of Following Natural Products - Starch, citric acid, pectin, lycopene, hesperidin, diosgenin, digoxin, sennosides, lawsone, phyllanthin, bacosides, vincristine, curcumin, lemon grass oil, sandal wood oil, quinine, morphine, atropine, emetine and caffeine.

Carbohydrates - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of glucose & sucrose.

Glycosides - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of cardiac glycosides - digoxin, anthracene glycosides - sennosides.

Vitamins - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of ascorbic acid.

Steroids - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of cholesterol.

Plant Hormones - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of auxins.

Terpenoids - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of citral, menthol and zingiberene.

Natural Pigments - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of carotene, lycopene, bixin, chlorophyll, quercetine and indigotine.

Alkaloids - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry, structural elucidation of quinine, morphine and atropine.

Purines - Introduction, definition, classification, nomenclature, source, importance, structure, chemistry,

structural elucidation of caffeine.

Natural Products as Markers for New Drug Discovery - The role of natural products chemistry in drug discovery, selection and optimization of lead compounds for further development with suitable examples.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Phytopharmacy and Phyto Medicine	<b>Subject Code</b>	PHD102PS21

### Course Content

Phytochemical Screening of Crude Drugs - Extraction, isolation, purification, characterization of phytoconstituents belonging to following classes: alkaloids, glycosides, flavonoids, terpenoids, saponins, lipids,

Structural elucidation of phytoconstituents.

Standardization of Following Phytopharmaceuticals by - UV, IR, HPLC, and HPTLC, GCMS techniques. vasicine, andrographolides, phylanthin, solasodine, gingerol, bacoside, curcumin, lupeol.

Brief Introduction to Pharmacological Screening Methods with Example of Following Category of Medicinal Herbs - Hepatoprotectives, antidiabetics, antiepileptics, hypolipidaemics, antioxidants, anti-inflammatory, analgesics.

Study of Herbal Extracts - Processing, equipment and analytical profiles. Sterility, stability and preservation of extracts

WHO Guidelines for assessment of crude drugs. Evaluation of identity, purity, and quality of crude drugs. Determination of pesticide residue.

Determination of arsenic and heavy metals. Determination of micro-organisms.

Phytochemical Screening - Preparation of extracts, phytochemical tests for detection of common plant constituents, biosynthetic pathways for secondary plant constituents, general principles of formation of primary and secondary plant metabolites.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Quality Assurance and Pharmacy Regulatory Affairs	<b>Subject Code</b>	PHD102PS22

### Course Content

Quality Control and Assurance Technique - Basis concepts of quality, developing quality culture

Quality Assurance General Concepts - Definition of quality assurance concept and components of Q. A., good manufacturing practices, quality control – the concept

Personnel, Premises and Equipments - Qualification, experience, training responsibilities and hygiene of personnel, drainage system, sewage, sanitation, lighting, maintenance of building and premises; design, size, location, construction, cleaning and maintenance of equipments. documents and formats related to personnel, premises and equipment.

Material Management - Purchasing, raw material, packaging materials, intermediate and bulks products, finished products, rejected and recovered materials, recalled products, returned goods, reagents and culture media, waste materials, reference standards, miscellaneous material. documents and formats.

Manufacturing Operations and Control - Revised schedule M, sanitation of manufacturing premises, mix –ups and cross contamination, processing of intermediates and bulk product, packaging operations, I.P.Q.C., Release of finished products process deviations, drug product inspection, expiration dating, document and formats.

Documents and Records - Specification, master production and control record, batch production and control record, significance of SOPs and record, change control, drug master file, documents and formats.

Pharmaceutical Validation - Definition & concept of validation, validation of building, equipments, instruments and facilities, process validation, cleaning –validation, validation master plan, documents and formats.

Quality Control of Biological Products: International biological standards, safety testing of pharmaceutical quality control of antibiotics.

Pharmaceutical Plant Audit - Department wise documents and audit questionnaire.

## Ph. D. Course Work Syllabus

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Sterile Pharmaceutical Products - GMP aspects related to sterile products- General guidelines, personnel, building and premises, equipment, sanitation, processing, sterilization, quality control and validation, documentation Origin, development, scope, objectives and nature of Pharmaceutical legislation in India. History and ethics of profession of Pharmacy. A study of regulatory aspects that affect drug product design, manufacture and distribution in India with special emphasis on the detailed study of the following Acts (with latest amendments)

The Narcotics Drugs and Psychotropic Substances Act, 2001 Medicinal and Toilet Preparations (Excise Duties) Act, 1955. The Pharmacy Act, 1948.

The Drugs and Cosmetics Act, 1940 and Rules there under. Drugs (Price Control) Order in force.

Introduction to Intellectual Property Rights; Copy Right Act, Trade Mark Act, Patent Act and Biodiversity Act, WTO, TRIPS and TRIMS.

The Drugs and Magic Remedies (Objectionable Advertisements) Act, 1955. Prevention of Cruelty to Animals Act

Legal Environment of Business- Need for government regulations; financial regulations, SEBI, BIFR, FEMA and others, Contract Act and Sale of Goods Act, Company Act, Corporate tax laws. Indian Patent Law: Critical evaluation of development of Indian Patent law with necessary changes. Comparison with US and EP Patent Law

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- New Drug Delivery System	<b>Subject Code</b>	PHD102PS23

### Course Content

Optimization - Definition, need, advantages, Meaning of general terms involved in optimization process. Classification of optimization methods.

Brief description and importance of experimental design with special reference to designs adequate for large number of variables. Introduction of correlation & regression analysis & mathematical model, contour plots. Basic understanding with at least one example of following optimization techniques:- Simplex method, langarengian method, EVOP, grid search method.

Controlled Drug Delivery Systems (CDDS) - Concepts and rationale, classification of controlled release systems, carriers for CDDS, design and evaluation. Release kinetics.

General Considerations and Applications of following Drug Delivery System - Bioadhesive and mucoadhesive drug delivery, nasopulmonary drug delivery, ocular drug delivery, pro- drug, transdermal implants and inserts, colon, osmotic drug delivery systems..

Molecular basis of targeted drug delivery.

General considerations, methods of preparation, characterization and applications of following drug delivery systems - Liposomes, niosomes, nanoparticles, solid lipid nanoparticles, resealed erythrocytes, dendrimers, multiple emulsions, submicron emulsion, fullerenes, i.e., carbon nanotubes, nanorods, and self-assembling nanostructures.

An overview and applications of following drug delivery systems - Aquasomes, pharmacosomes, transfersomes, liquid crystals, magnetically modulated drug delivery, peptide and protein drug delivery.

Nanocarriers and targeted drug delivery.

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmaceutical Chemistry	<b>Subject Code</b>	PHD102PS24

### Course Content

Aromaticity, electrophilic and nucleophilic substitution in aromatic systems, E1, E2 mechanisms, Hofmann and Saytzeff elimination, competition between elimination and substitution, intramolecular elimination, addition reactions, Markovnikov's rule, nucleophilic additions, hydride transfer reactions, Cram's rule, participation of neighboring groups in transannular rearrangements.

Stereochemistry - Molecular dissymmetry, compounds with one or two or more unequal asymmetric carbon atoms, configurations, absolute, relative, racemic modifications, optically active compounds, cyclohexane, six membered heterocyclic rings stereoisomerism of allenes and related compounds.

Survey of recent advances in following areas, brief chemistry, and synthetic approach to marketed drugs, mode of action, SAR, of following class of drugs - Cardiovascular (antihypertensives, antiarrhythmics, antianginals, cardiotonics), CNS (anesthetics, sedative-hypnotics, anticonvulsants, antipsychotics and CNS stimulants), immunosuppressants, immunostimulants, antibacterials, antivirals, antineoplastics, drugs for tropical diseases and malaria, tuberculosis, leprosy, amoebiasis, and leishmania, radio protectives and drugs against ageing, diuretics, antihistaminics, cholinergic and anticholinergics.

Microorganism in Drug Synthesis - Introduction, theoretical and practical aspects of microbial transformation, microbial conversion of antibiotics.

Molecular concept of drug receptor interactions. Advances in following classes of receptors and their drug ligands, opioid, dopamine, adrenergic, cholinergic, histamine, 5-HT<sub>1A</sub>, GABA. Combinatorial Chemistry - Solid phase synthesis, different types of polymer supports, linkers, strategies of library synthesis and characterization solid phase strategies

General Strategies and Concepts - Specific implementation issues (solid support, anchoring chemistry, coupling chemistry, protection schemes, analytical methods), solution phase analysis

A general study of co-relation of physicochemical properties and stereochemistry and drug action. Isosterism and bio-isosterism as guides to structural variations, metabolite, antagonism and theory of drug action.

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An overall treatment of various approaches to drug design including the method of variation, e.g. Fibonacci search, Topliss tree, Craigs plot, Simplex methods, and Cluster analysis. Quantitative structure-activity relationships (QSAR) with detail coverage of Hansch's Liner method, free and wilson methods, mixed approached principal component analysis and application

Computer Aided Drug Design - Basic concept of computational chemistry like quantum mechanics, molecular mechanics, force fields, energy minimization, conformational reaction, molecular dynamics. Liqand based drug design based on active site of receptor/enzyme.

Indirect Drug Design - Analog approach, pharmacophore mapping, template forcing, excluded volume & shape analysis, artificial intelligence methods.



## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Industrial Pharmacy	<b>Subject Code</b>	PHD102PS25

### Course Content

Physics of tablet compression - Compression and consolidation, strength of granules, compression and consolidation under high loads, effect of friction, distribution of forces in compaction, force volume relationships, Heckel plots, compaction profiles, energy involved in compaction, strength of tablet, crushing strength, friability, lamination, instrumentation of tablet machines.

Diffusion and dissolution - Steady state diffusion-procedure and applications, drug dissolution, drug release, diffusion principles in biologic systems, thermodynamics of diffusion, Fick's second law. Devices for dissolution rate testing viz., forced convection, non-sink devices, and continuous flow through methods; effect of environmental factors in dissolution testing; test apparatus for topical, transdermal products, suppositories, and controlled release products; in vitro-in vivo correlation.

Theories on stability of disperse systems - Adsorption, wetting, crystal growth mechanisms, physical stability of suspensions and emulsions, stability testing of emulsions and suspensions and release of drugs from suspension and emulsion formulations. Biopharmaceutical aspects of disperse systems.

Rheology - Theoretical consideration, instrumentation, rheological properties of disperse systems and semisolids.

Kinetics and drug stability - Stability calculations, rate equation, complex order kinetics, kinetics of some decompositions, strategy of stability testing, method of stabilization, method of accelerated stability testing in dosage forms, Freeze Thaw methods, centrifugal methods, temperature and humidity control, physical stability testing of pharmaceutical products.

General Consideration, Preparation of Master Manufacturing Procedure - Material Handling, blending, granulation, drying, slugging compression, coating liquid dosage forms contract manufacturing

Production and Planning Management - Space allocation, environmental factors, manufacturing, materials management, sales forecasting, cost control.

Drug Regulatory Methods – Definitions, federal food, drug and cosmetic act, kafaarver harre's amendments, new drug application, drug efficacy study, implementation review, otc drug review, drug listing. drug amendments, patents, copy right, trade marks, drug recalls, product liability, clinical trials.

Good Manufacturing Practices - GMP in manufacturing, Processing, packaging and holding of drugs, control of components, containers and closures, production and process controls,

## Ph. D. Course Work Syllabus

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packaging & labeling controls, inspection for compliance with GMP potable water standards, premises, design, construction, maintenance, equipment, maintenance, warehousing, ISO 9000 certification.

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Hospital and Clinical Pharmacy	<b>Subject Code</b>	PHD102PS26

### Course Content

The role of hospital pharmacy department and its relationship to other hospital departments and staff.

Pharmacy and Therapeutics Committee - Selection of drugs, hospital formulary development and management, assessing drug efficacy, assessing and managing drug safety, evaluating the cost of pharmaceuticals, identifying and addressing drug use problems including standard treatment guidelines, other hospital committees such as infection control committee and research & ethics committee.

Hospital Pharmacy Management - Staff (professional and non-professional), materials (drugs, non-drugs, consumables), financial (drug budget, cost centres, sources of revenue, revenue collection), policy and planning, infrastructure requirements (building, furniture and fittings, specialised equipment, maintenance and repairs), workload statistics.

Hospital Pharmacy Services - Purchasing, storage, stability and safety of drugs, drug distribution, Radiopharmaceuticals, additive services and total parenteral nutrition.

Concept of rational use of drugs - Importance of rational drug use, pharmacists role, drug use indicators, guidelines for rational prescribing.

Education and Training - Training of technical staff, training and continuing education for pharmacists, pharmacy students, medical staff and students, nursing staff and students, formal and informal meetings and lecturers, drug and therapeutics newsletter ethical issues in biomedical research – Principles of ethics in biomedical research, good clinical practice [ICH GCP guidelines], ethical committee [institutional review board], its constitution and functions, ethics of publication.

Medication Error and Medication Adherence - Categories and causes of medication error, tools to measure the performance of the medication use process, categories of medication non-adherence, role of pharmacist in medication error and medication adherence.

Introduction to Clinical Pharmacy - Definition, development and scope.

Patient Data Analysis - The patient's case history, its structure and use in evaluation of drug therapy, presentation of cases. Communication skills including patient medication history interview, patient counselling, teaching skills. Understanding common medical abbreviations and terminologies used in

clinical practices. Haematological, Liver function, renal function, tests associated with cardiac disorders. Fluid and electrolyte balance, common tests in urine, sputum, faeces, CSF. Sensitivity screening for common pathogenic micro-organisms, its significance, resistance in disease states and selection of appropriate anti-microbial regimens.

Research Design and Conduct of Clinical Trials - Research support including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. Monitoring and auditing of clinical trials. Design and execution of trials in different clinical settings.

Clinical Pharmacokinetics - Clinical pharmacokinetic models. Physiological determinants of drug clearance and volumes of distribution. Renal and non-renal clearance. Organ extraction and models of hepatic clearance. Estimation and determinants of bioavailability. Multiple dosing. Calculation of loading and maintenance doses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients. Therapeutic drug monitoring.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Drug Discovery & Drug Development	<b>Subject Code</b>	PHD102PS27

### Course Content

Introduction to Drug Discovery - History of drug discovery, sources of drugs (plants, animals, microorganisms, drugs from organic synthesis), existing drugs as a source of new drug to screen new drug leads, lead identification and optimization.

Novel Drug Targets for Drug Discovery - Exploration and investigation of therapeutic drug targets as enzymes, receptors, cytokine, genes, platelets, matrix metalloprotease, other targets (transporters etc) for drug design.

Model Approaches of Drug Discovery from Natural Sources - Selection of natural sources for drug discovery based on phytoconstituents, chemotaxonomy, ethnopharmacological records and random approach. Chemical constituents and compound extract as drugs, synergy principle in plant drugs. Plant secondary metabolites as new drug templates. Preparation of plant material for biological evaluation. Bioactivity guided fractionation. Separation techniques for isolation of lead molecules. Natural product libraries and recent development in natural products.

Drug Discovery from Synthetic Strategies - Protection and deprotection of various groups; Polymorphism in drug discovery.

Drug Design Tools - Conventional methods of drug design, lead, discovery of lead, lead optimization, pharmacophoric identification and analog approach of drug designing.

Various Approaches in QSAR - Objectives of QSAR, Hansch approach, Free-Wilson model, statistical methods, non-computer assisted search operations like topliss decision tree simplex method, fibonacci search technique.

Parameterisation of Groups / Molecules - Electronic, steric and lipophilic molecular descriptions, quantum chemical calculations.

Introduction to molecular modeling. Currently used drug discovery tools in pharmaceutical industry.

Preclinical Studies and Drug Development - Stages of drug discovery, stages of pre-clinical and safety evaluation, acute, sub-acute, chronic studies, in-vivo and in-vitro studies (behavioral, biochemical, neurochemical models), special studies including carcinogenicity, mutagenicity, teratogenicity studies.

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Pharmacokinetic Studies in New Drug Discovery - Introduction, relation of drug metabolism to drug design structure, absorption-distribution relationship- significance for drug design. Prodrug concept in new drug discovery.

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Biopharmaceutics	<b>Subject Code</b>	PHD102PS28

### Course Content

Introduction, concentration time profile, plotting the data, different fluid compartments and blood flow rates compartment models.

Protein and tissue binding, factors effecting protein binding, kinetics of protein binding, determination of rate constants and different plots (direct, scatchard and reciprocal); Significance volume of distribution, implications and in vitro methodologies.

Pharmacokinetic Characterization of Drugs - Absorption rate constants (Wagner-Nelson, Loo-Reigelman methods), limitations, lag-time, pharmacokinetics in presence of lag-time; flip- flop model.

Drug disposition, renal clearance, mechanism of clearance, clearance ratio, determination of clearance, hepatic clearance, % drug metabolized, relationship between blood flow, intrinsic clearance, hepatic clearance and protein binding, different volumes of distribution, significance, and integration kinetics.

Pharmacokinetics of multiple dosing, dosage regimen design based on mean average, minimum and maximum, plasma/serum concentrations, limited fluctuation methods; Repeated one point method; Dosage adjustment in disease patients.

Nonlinear pharmacokinetics, direct, liner and orbit graph methods of dosing. Non-linear pharmacokinetics due to drug-protein binding.

Chronopharmacokinetics - Drug toxicity and forensic, pharmacokinetics, case study, pharmacokinetics in elderly, drug dosage in children, obese patient, first dose size, kinetics of maternal-fetal drug transfer, pharmacokinetics- pharmacologic/clinical response, distribution kinetics, metabolic kinetics, dose and time dependencies, turnover concepts, small volume of distribution, dialysis.

Biopharmaceutics and pharmacokinetics in drug research.

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Clinical Practice and Research	<b>Subject Code</b>	PHD102PS29

### Course Content

Introduction to Clinical Pharmacy - Definition, development and scope

Introduction to Daily Activities of a Clinical Pharmacist - Drug therapy monitoring (medication chart review, clinical review, pharmacist intervention), ward round participation, adverse drug reaction management, drug information and poison information, medication history, patient counseling, pharmaceutical care, drug utilization evaluation (DUE) and review (DUR), quality assurance of clinical pharmacy service.

Patient Data Analysis - The patient's case history, its structure and use in evaluation of drug therapy, presentation of cases. Communication skills including patient medication history interview, patient counselling, teaching skills. Understanding common medical abbreviations and terminologies used in clinical practices. Haematological, liver function, renal function, tests associated with cardiac disorders. Fluid and electrolyte balance, Common tests in urine, sputum, faeces, CSF. Sensitivity screening for common pathogenic micro-organisms, its significance, resistance in disease states and selection of appropriate anti-microbial regimens.

Research design and conduct of clinical trials: Research support including planning and execution of clinical trials. Guidelines for good clinical research practice and ethical requirements. Various phases of clinical trials. Categories of Phase IV studies. Monitoring and auditing of clinical trials. Design and execution of trials in different clinical settings.

Clinical Pharmacokinetics - Clinical pharmacokinetic models. Physiological determinants of drug clearance and volumes of distribution. Renal and non-renal clearance. Organ extraction and models of hepatic clearance. Estimation and determinants of bioavailability. Multiple dosing. Calculation of loading and maintenance doses. Dose adjustment in renal failure, hepatic dysfunction, geriatric and paediatric patients. Therapeutic drug monitoring.

Statistics - Basic concept of biomedical statistics, descriptive and differential statistics, statistical test-parametric and non parametric, sample size calculation, confidence intervals, test of significance.



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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Pharmaceutical Sciences	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Pharmacy Management	<b>Subject Code</b>	PHD102PS30

### Course Content

Pharmaceutical Management - Meaning, evolution-scientific, administrative and human relation approach. Process of management: planning, organizing, staffing, directing, coordinating and controlling—a preliminary idea of concepts, processes and techniques.

Fundamental concepts of production, financial, personal, legal and marketing functions with special reference to Pharmaceutical Management. Introduction to budgeting, costing, accounting, auditing and budgetary control. Entrepreneurship development.

Understanding Organizations - Meaning, process, types of organization structures and departmentation, line/staff authority, promoting organizational culture. Organizations, pharmaceutical services and functioning of hospital pharmacy, bulk drug unit, formulation unit, Ayurvedic and Unani manufacturing units and testing labs etc.

Decision Making - Types, procedures, evaluation and selection of alternatives, decision making under various situations. Management information and decision support systems and time management.

Personnel Management - Job Analysis, recruitment, selection, orientation and training, performance appraisal and compensation. Retrenchment, lay off and discharge.

Management of Industrial Relations - Industrial disputes, settlement of disputes through various routes such as bargaining, etc.

Motivational aspects, theories of motivation, group dynamics, rewards and incentives, interpersonal skills, significance of communication, its processes, measures for effective communication, conflict management. Stress management.

Production Management - Fundamentals of production, organization, economic policy, manufacturing economics, production capacities, production lines and job balancing, visible and invisible inputs, methodology of activities. Development of efficient work methods, quality control and management of R&D.

Considerations for design of large scale manufacturing units including intricate design criteria for units to manufacture sterile and non-sterile products with special reference to tablets, capsules,

and injections. Design and development of packaging units including recent advances in packaging techniques for various types of sterile and non-sterile dosage forms.

Warehousing design, construction, maintenance and sanitation; good warehousing practice, materials management.

Pharmaceutical Marketing: Evolution of marketing concept; production oriented, sales oriented, promotion oriented and consumer oriented (modern concept); market segmentation; concept of marketing mix role of 7 P's (product, price, promotion, place, physical evidence, process, people) in pharmaceutical marketing

Management, corporate planning & strategy, pharmaceutical industrial marketing management. Pharmaceutical marketing environment. Product management. E-Pharma marketing.

Product Planning - Selection of product, new product development and product differentiation, pricing, promotion – personal selling; salesmanship, qualities of salesman, management of sales force, advertising, publicity and window display, channels of distribution.

Marketing Research - Definition and importance, pharmaceutical marketing research techniques, marketing information system, pharmaceutical marketing research area.

Market Demands and Sales Forecasting - Major concepts in the demand measurement, estimating current demands, geo-demographic analysis, estimating industry sales, market share and future demand, sales forecasting.

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Physics	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Physics	<b>Subject Code</b>	PHD102PH01

**Course Content**

**Basics of computers**

Anatomy of computer and their classification: Input and output devices. Concepts of computer ware, Language processors and computer languages. Introduction to operating system . Concepts of OLE. Basis of MS Office, MS word, MS Excel, MS Power point. Interact and Email basis. Web search Engine.

**Basis of Research Methods & Scientific Presentation**

Concept of research: Definition and objectives. Research approach and types of research, criteria of good research, defining research problems.

Research design: Features of good research design. Different research design with references to Physics. Basic principles of experimental research design. Structures and components of Research report/ Papers/ Thesis skills for scientific presentations.

**Quantitative Methods**

Nature and purpose of Mechanical statistics, Tabulation and statistical interference- Tabular and graphical representation of data. Bar, Pie and radar diagrams. Sample mean and variance.

Correlation and correlation coefficients, Random sampling. Introduction to random and pseudo random numbers, Random numbers generators. Estimation of parameters, Confidence intervals.

Types of errors and its scope of research, Goodness of – square test. Method of least squares, fitting straight lines and polynomials. Data analysis using Fourier techniques. Idea of convolution and de-convolution.

**Experimental methods on material research**

Material preparation methods. General idea of preparation of crystalline, nano-crystalline and polymeric material including film state reaction method. Wet chemical method. Solution cost technique. Electro deposition method. Dip coating method. Spin coating method. Elementary idea of vacuum technology and vacuum coating methods (Elementary idea only)

Materials Characterization techniques-26 Elements of experimental tools in material research. Concept of interferometry and application to measurement of film thickness. Basic principles and applications of

SRD, SEM, DSC, TEM, FTIR, NMR. Impendence spectroscopy.

**Modelling and observational techniques in space science.**

Theoretical modelling methods. Bisection method. Runa – Kutta method and simpson's rule. General idea of mathematical modeling and simulation- Monte Carlo technique. Rendom walk problem.

Methodology of space Reseach- Telescope observations. Optical and radio telescopes. Ground based and satellite observations. Solar interplanetary and geomagnetic parameters. Cosmic ray detector. Extracting scientific information from space data.

Cosmic ray detectors.

Extracting scientific information from space data. Cosmic ray. Review of theories of origin- solar. Galactic and extragalactic cosmic rays. Supernovae origin.

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<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Political Science	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Political Science and Public administration	<b>Subject Code</b>	PHD102PL01

### Course Content

Nature of research: Pure and applied research.

The scientific method: A history of scientific method, step of scientific method and techniques.

Formulation of research design- Hypothesis and concepts.

Source of data and their collection- Primary and secondary data, content analysis, observation, questionnaire, schedule interview, survey, mechanical aids-tape recorder and computer etc.

Techniques of field work, participant and non-participant, life study and interviewing.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Sanskrit	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Advance in Sanskrit Language	<b>Subject Code</b>	PHD102SL01

### Course Content

#### (A) Language Learning

- 1 Definition of Language
- 2 Physical and Mental Process of Language
- 3 Field and Subject of Science of Language
- 4 Censes and Kinds Of phonetical changes in language

#### (B) Origin and Development of Sanskrit Language

- 1 Old Tradition of Sanskrit Language
- 2 Vowels and Consonants in Sanskrit
- 3 Word –Fours and Verb farms of Sanskrit
- 4 Difference between VEDIC Sanskrit and Classical Sanskrit

#### (C) Documentation Skill Logic Of Footnotes

- 1 Primary Footnotes
- 2 Footnotes Numbers
- 3 Modal Footnotes
- 4 Articles in Periodicals
- 5 parenthetical documents
- 6 secondary Footnotes
- 7 conman Abbreviation
- 8 Transliteration
- 9 Cross Reference

#### (D) Course titles

##### I Vedic Literature

- a) Vedic Culture & Literature  
Vedic Sanskruti and Sahitya :Gautam Patel
- b) Vedanga Literature  
Nirukta: Adhyayas:1,2 & 6

(With the Commentary of Durga)

##### II Puranetihaasa

##### Arshamahakavyas

##### (A) Puraana Literature

: Origine and Development

Purnavimarsha : Baldev Upadyay

##### (B) Mahabharat Sabhaparva

##### III Classic-Modern Sanskrit Literature

##### (A) Sanskrit Sahitya ka Itihasa :Radhavallabh Tripathi

Post Independence Sanskrit Literature : A Critical Survey(Prof. Dr. A.M. Prajapati Feicitation  
Volume: M.K. Prajapati)

##### (B) Literary Texts:

Harshacharitam (Chap.1) :  
Baanabhatta  
Abhijnana Saakuntam  
Kalidaasa  
Kiratarjuniyam (Canto: 1)  
:Bhaaravi  
Sanskrit Gitaanjali – Dr.A.  
M. Prajapati





<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Social Work	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Social Work	<b>Subject Code</b>	PHD102SW01

**Course Content**

**Theories and Practice Models in Social Work:** Overview of practice Models: *Micro, mezzo and macro practices*, Creating Frameworks for Social Work Practice -Systems and Ecological Theories, Cognitive Behavioural theories, strengths based, Rights based and Bottom up approaches. Problem Solving model, Task Centered model, Cognitive Behaviour model, solution focused model, Crisis Intervention model, case management model, advocacy model, empowerment Model. Evidence based and culturally competent practice in Social Work

**Indigenisation vs Internationalisation:** International social work-concept, values and standards, strategies, programmes, Theories and concepts basic to international social work – globalization, development and human rights Local & Global Issues – poverty, conflict, displacement and forced migration, refugees and specific populations HIV/AIDS, Gender-based violence, trafficking in persons, Disability, children separated from their families, Global Warming & climate change

**Strategies and Approaches in International Social Work:** Strategies of international social work practice - empowerment, capacity building, self-reliance, social integration. Approaches to international social work– global perspective, human rights perspective, ecological perspective, social development perspective. International relief and development. Regulatory bodies in International Social Work: IFSW, IASSW, ICSW

**Global Social development Policies:** United Nations Summit For Social Development, United Nations Millennium Development Goals and targets, United Nations Convention on the Rights of the Child.

**International Social Work Education and Research:** Multiculturalism in social work education, values and ethics for international professional action, use of social work methods in multicultural contexts, developing global policies for social work education in globalised environment, Global standards for the education and training of the Social work profession,2004, strategies and challenges of field work and research in international social work.

## Ph. D. Course Work Syllabus

<b>Course</b>	Doctor of Philosophy		
<b>Branch</b>	Zoology	<b>Contact Hours</b>	75
<b>Subject Name</b>	Elective- Zoology	<b>Subject Code</b>	PHD102ZL01

### Course Content

Sampling technique, sterilization technique, various methods for isolation of pure culture methods for measurement of microbial growth, manipulation of environment, nutritional and genetic parameters, maintenance and preservation of microbes (pure culture). Introduction to Cell & Tissue Culture. Design & lab setup of Tissue Culture laboratory, Tissue culture Media (Composition preparation), Types of culture.

**Chromatographic techniques** – Gel filtration, ion exchange chromatography, hydrophobic interaction and reverse phase chromatography, affinity chromatography, gas chromatography, high performance liquid chromatography, fast protein liquid chromatography; Application in separation of proteins including enzymes.

**Molecular Biology and spectroscopic techniques** – Comet Assay; Real time PCR; RAPD, RFLP, ARDRA and Fluorescence *in situ* hybridization techniques. Atomic absorption spectroscopy, infrared spectroscopy, nuclear magnetic resonance

spectroscopy, mass spectrometry including ESI MS and MALDI-TOF MS and Applications.

**Electrophoretic and centrifugation techniques** - SDS and Native PAGE, Agarose gel electrophoresis, isoelectric focusing and two-dimensional electrophoresis, proteome analysis;

Differential and density gradient centrifugation, analytical ultracentrifugation, separation of DNA/RNA using ultracentrifugation technique, determination of molecular weight and Sedimentation coefficient.

**Quantitative methods;** Principles and Designs of Experiments; Tools Parametric and

Non~parametric statistics. Confidence interval, Errors. Levels of significance, Regression and Correlation coefficient. Analysis of variance for one way and two way classifications; Multiple Comparisons – Least Significant Difference Test, Duncan's New Multiple Range Test; Factorial Analysis; Analysis of Covariance.

Features and applications related to presentation of text in suitable format and saving the MS WORD data for future applications. Practical knowledge of MS Word to type the script, insert tables, figures and graphs to prepare thesis and research papers in presentable format.,

MS. Use of statistical tools, preparation of graphs, histograms and charts, Preparation of powerpoint presentations based on the topic of research, Data processing, Data mining; Bioinformatics – Concept and applications; Biological databases – Primary and Secondary; Sequence Databases (EMBL, GenBank, DDBJ, SWISS PROT, PIR, TrEMBL); Protein Family/Domain Databases (PROSITE, Pfam, PRINTS & SMART); Structure Database (PDB); Tools like BLAST, FASTA and EMBOS